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FRESH RELICS OF GLACIAL MAN AT THE BUFFALO MEETING OF THE A. A. A. S.

BY G. FREDERICK WRIGHT.

1. The first paper upon this subject was presented by Prof. G. Frederick Wright, detailing briefly the results of a single day's exploration at Trenton, N. J., under the guidance of Mr. Ernest Volk, who is continuously carrying on similar explorations under Prof. F. W. Putnam for the Peabody Museum at Cambridge and the Central Park Museum, New York City. Professor Wright was requested to select his own ground upon the Lalor farm, where permission has been given for exploration, and the surface to a depth of three feet would be dug over in his presence. The point selected is on the bluff of the terrace of glacial gravel upon which the city of Trenton is built, a mile or more south of the center of the city. The bluff here facing the river is about fifty feet above it, and the terrace stretches back in a dead level for a mile and a half. The situation is such that there was no chance for surface wash to have remodified the deposit. In the near vicinity were boulders two or three feet in diameter resting upon the surface, or slightly below it, showing the ordinary conditions of deposition in connection with floating ice which characterized the whole delta terrace at Trenton, and which have been so often described by the geologists who have visited the region.

A trench three feet deep and three feet wide was dug from the face of this bluff backwards about thirty or forty feet. The upper twelve inches of this trench consisted of sand discolored with vegetable decomposition, which had evidently been disturbed. In this stratum there were found two flint arrow-heads or spear-heads, one argillite chip, and one flint chip, together with a fractured pebble, four pieces of pottery, and a piece of charred bone.

The lower two feet of the excavation, except where interrupted by a pit, consisted of compact sand distinctly stratified, which had clearly been undisturbed. In this was found at varying depths one imperfect argillite implement, about three inches long and an inch and a half wide and a quarter of an inch thick, with five unrolled and angular fragments of argillite, two of which bore pretty clear evidence of having been chipped by human hands. These were the only fragments. There were no chippings or fragments of flint or jasper in the lower two feet of the excavation.

This brief paper of Professor Wright was but the prelude to bring out from Professor Putnam a fuller statement of the results of Mr. Volk's work on the Lalor farm. For two years Mr. Volk has been carrying on similar excavations over adjoining parts of the farm where the situation is similar to that described, and with corresponding results. Flint and jasper implements and flakes are abundant in the upper twelve inches of the soil, while no flint or jasper occurs in the lower two feet, of undisturbed sand and gravel. A large number of boxes of implements and fragments accumulated by this work of Mr. Volk have been sent up to the museums above mentioned; but, owing to the lack of time, Professor Putnam has not yet opened them and published the results. But in preparation for this meeting Professor Putnam had requested Mr. Volk to pursue further investigations and send the results to him at Buffalo. These were presented by Professor Putnam in a paper from Mr. Volk describing between thirty and forty argillite implements and fragments which had been found in his subsequent excavations in the undisturbed lower two feet of sand, as described in Professor Wright's excavation. As in that

case, so in this, flint and jasper were abundant in the upper twelve inches, but argillite was the only chipped and angular material found in the lower two feet. A large diagram accompanied Mr. Volk's description in which the position of each one of these argillite fragments was found. The box was then opened for the first time, and the fragments presented for examination. Of the artificial character of many of them there was not the least question on the part of any one present.

The importance of these discoveries as confirming the evidence of glacial man at Trenton heretofore presented can readily be perceived. It coincides with that presented by Professor Putnam and Dr. C. C. Abbott and Mr. Volk, going to show that there was a clearly marked succession in the human occupancy of the Delaware Valley indicated, first, by the sole use of argillite for implements, followed by a gradual and almost complete transition to the use of flint and jasper in later times. (See Putnam's report to the Peabody Museum in the Proceedings of the American Antiquarian Society, October, 1889, p. 11, and Observations upon the Use of Argillite by Prehistoric People in the Delaware Valley in Proceedings of the American Association for the Advancement of Science, by Ernest Volk, vol. xlii, p. 312). It also sweeps away at once the ingenious theories of Professor Chamberlin and others who would account for the occurrence of implements in the lower strata of sand and gravel through the agency of dry-weather cracks in the surface, the overturning of trees, the decay of tap roots, and the activity of burrowing animals; for none of these agencies would select the argillite, and leave the flint and jasper upon the surface. Therefore it would seem that there can be little doubt that these argillite fragments were scattered by the agency of man at the time that the deposition of the Trenton gravels was still in progress.

2. A second paper was by Prof. E. W. Claypole, detailing the particulars concerning the discovery of human relics from the drift at New London, Huron County, Ohio. These consisted of what would be called Neolithic axes, found by an intelligent workman in the process of well-digging in the blue till twenty feet below the surface. The circumstantial evidence

sustaining the testimony of the workman is of the most convincing character. The passage from the yellow till into the blue till and the occurrence of occasional strata of gravel are characteristic of the glacial deposits of northern Ohio. The implement had been subjected to oxydizing agencies characteristic of the deeply covered strata of that immediate vicinity. It is impossible briefly to detail this evidence. We must therefore wait for its full publication by Professor Claypole.

In a word, the geological situation at New London, Ohio, is this: The watershed between the Great Lakes and the Ohio is but a few miles to the south, and drains to the north through the main valley of Vermillion River. The land about New London is level for several miles, and is about two hundred feet below the summit of the watershed. There is no opportunity for any disturbances to have occurred subsequent to the glacial period; but in the retreat of the ice from the watershed a temporary glacial lake doubtless occupied the upper part of the valley of Vermillion River, emptying its waters into a tributary of the Mohican, and thence into the Muskingum and the Ohio. But this lake evidently did not exist for a great length of time.

Heretofore numerous flying reports of the discovery of implements in the glacial till have been made, but this is the first instance where the evidence has seemed in itself altogether convincing and satisfactory.

RELATIVE EFFICIENCY OF ANIMALS AS MACHINES.[1]

By Manly Miles, Lansing, Mich.

In my paper on Energy as a Factor in Rural Economy, read at the Washington meeting of the Association, approximate quantitative estimates were made of the energy expended

[1] Read in Section F. at the Buffalo meeting of the American Association of Science, Aug., 1896.

in the exhalation of water by plants, and evaporation from the soil; and at the Madison meeting similar estimates were given of the potential energy of an acre of corn, and of a fat ox, as representing the work done in the constructive processes of growth. The substance of the last mentioned paper, with some additional matter was published in the AMERICAN NATURALIST of July, 1894.

Some further illustrations of the same general principles are now presented in an inquiry as to the relative efficiency of different classes of animals, as machines, in utilizing the potential energy of their food in useful work.

From the imperfect data now available, there are many questions relating to this subject that cannot be definitely answered, but the approximate quantitative estimates we are able to make must be of interest in suggesting the lines of research required for a satisfactory solution of the problems involved in discussing the economy of foods and diets, and especially in the interpretation of the results of feeding experiments.

The chemical theories of nutrition have been so generally accepted in popular expositions of alimentary processes that it may be well to recapitulate the leading facts relating to energy as a factor in physiology in order to clear up the field of view and give due prominence to the principles we have to deal with.

The food consumed by animals serves two distinct purposes which should be clearly distinguished. The materials required in building tissues, and in the manufacture of animal products (meat, milk, wool, etc.), have alone been noticed in popular essays on the subject of nutrition, while the quite as important expenditures of the energy supplied in foods, as the motive power required in the constructive processes involved in converting the food constituents into animal tissues and products, have been misinterpreted or entirely ignored.

As pointed out in the papers above noticed, but a limited amount of the constituents of foods are stored up by animals in their processes of growth—in their increase when fattened —or in the animal products they manufacture. With refer-

ence to our present subject, the following table, showing the percentage of food constituents found in the increase of fattening animals at Rothamsted, will serve as a sufficient illustration.

TABLE 1.

Percentage of food constituents in the increase of fattening animals.

Constituents of Food.	Stored in Increase.		
	Oxen.	Sheep.	Pigs.
	Per cent.	Per cent.	Per cent.
Proteids	4.1	4.2	13.5
Carbo-hydrates and fat	7.2	9.4	18.5
Ash	1.9	3.1	7.3
Dry Substance	6.2	8.0	17.6

It will be seen that much the larger part of the food constituents were not utilized by the animals as materials for building tissues, but they have served a useful purpose in yielding up more or less of their stored energy, according to the degree of disintegration to which they were subjected, which was made available in the constructive processes of nutrition and the related incidental physiological activities of the system.

With this limited demand for the constituents of foods to serve as materials for tissue building, there must be an extensive disintegration of their organic substance to furnish the enormous supplies of energy required in the repair of tissues, in increase in growth, in the vaporization of water exhaled by the lungs and skin, and to supply the sensible residue that is lost by constant radiation from the body in the form of animal heat.

The obsolete theory of Liebig that certain food constituents are alone used to build tissues and that certain other constituents are burned in the system to produce heat, still continues to be the leading assumption in attempts to popularize chemical theories of nutrition in formulating diets and nutritive

ratios, and attention should be directed to the erroneous interpretations of organic processes that are made in the application of this false theory in connection with a fancied analogy of the animal machine to a steam engine.

We are told that "when coal is burned in the furnace a part of its potential energy is transformed into the mechanical power which the engine uses for its work. The rest is changed to heat which the engine does not utilize, and which, therefore, is wasted. The potential energy of the food is transformed in the body into *heat* and *mechanical power. The heat is used to keep the body warm. The mechanical power is employed for muscular work.*"

As an outcome of this false analogy the term "fuel value of foods" has been introduced to serve as an index of their capacity "to keep the body warm," and provide for muscular work. The absurdity of these crude and superficial views of energy as a factor in nutrition will be readily recognized by physiologists and we need only notice some obvious inaccuracies of statement.

In the first place, there are no processes of combustion in physiological activities, and fuel as such, can have no value in animal nutrition. The assumption that the potential energy of foods not expended in muscular work is "used to keep the body warm," is in direct conflict with familiar physiological activities. There are large expenditures of energy in transforming to the form of vapor the water exhaled by the lungs and thrown off as perspiration by the skin and it is a well known fact in physiology that the body is cooled by the evaporation of water from the surface that is constantly taking place.

The laboring man, perspiring freely in hot weather, expends a considerable part of the potential energy of his food in the cooling process of vaporizing the water discharged by the skin as a result of his exertions. The law of the conservation of energy is strictly observed and there is no demand for fuel to burn to "keep the body warm." The heat liberated in the destructive metabolism of the tissues, or what we speak of as the wear and tear of the sytem, is disposed of in various ways,

and the large expenditure in the cooling machinery for vaporizing water is an important factor in securing a proper adjustment in equilibrium of the numerous physiological activities of the system.

The fallacious and misleading theories of nutrition we have noticed have been so widely disseminated in recent official reports and bulletins that a detailed statement of the role of energy in animal nutrition, as now recognized by physiologists, seems to be required in relation to our present subject.

The energy required as the motive power in building tissues and the elaboration of animal products, as well as that expended in muscular work, is all derived primarily from the potential energy of the organic substances consumed as food, and as an incident of the various metabolic processes of the system animal heat is produced.

The stored, or potential, energy of organic substances is an essential element of their constitution, representing the work done in their processes of construction, and it can be liberated in the form of heat by any of the various methods of disintegration to which they may be subjected. For example, when organic substances are burned the heat produced is a measure of the energy stored up in their construction, but this method of liberating heat from food constituents has no place in physiological processes, and the value of foods as fuel is not a legitimate subject of discussion in domestic economy.

Microbes disintegrate the organic substances on which they feed and liberate their stored energy in the form of heat, as in the familiar processes of fermentation. The numerous microbes in the alimentary canal add their quota to the available energy in the form of heat derived from the constituents of foods which they tear apart in feeding upon them. The digestion of foods by animals is another means of liberating the stored energy in the form of heat.

Destructive metabolism, resulting from the various activities of the animal machine, immediately follows the constructive processes and the stored energy of the tissues originally derived from food constituents is liberated as heat which, so

far as needed, is used again as the motive power in rebuilding the disintegrated tissues and other physiological processes.

Animal heat is, therefore, the result of physiological activities that are carried on in accordance with the laws of the conservation of energy, without the slightest indication of anything analogous to processes of combustion.

Living substance, as pointed out by Foster, is matter constantly undergoing change, energy being used and stored up in constructive metabolism, and liberated again as heat in the correlated and quite as essential processes of destructive metabolism. Energy doing work, or stored as potential energy in the tissues, cannot be detected by the thermometer, and the heat liberated from foods in the various processes of disintegration they undergo, and from the tissues through destructive metabolism, is again made latent, as far as it is utilized in doing the work required in constructive metabolism, in vaporizing water exhaled by the lungs or thrown off by the skin as perspiration, and animal heat is the sensible residue not disposed of in these physiological processes.

Our domestic animals may then be looked upon as machines for doing work in the repairs and other vital activities of the animal machine itself, including muscular exercise, and the manufacture of animal products used as food by man. The importance of these animal machines as factors in domestic economy leads us to inquire as to their relative efficiency in utilizing the potential energy of foods in the special work they are fitted to perform.

Aside from the individual and class peculiarities that require attention, their efficiency in utilizing energy must vary with the quality and quantity of food consumed and a tentative solution of the problems presented in this line of inquiry can only be made. The quantitative estimates of the expenditures of energy in different ways we are able to make must, therefore, be interpreted as representing approximately the results with the particular animals under the conditions to which they were subjected.

The feeding experiments at Rothamsted, and the composition of different animals and their increase, as shown in the

extensive series of analyses made there, furnish the most convenient and only reliable data for our purpose in the case of fattening animals. The average results with oxen, sheep and pigs, as estimated by Sir John Lawes several years ago, and the feed consumed and increase made by the "analyzed fat pig" have been taken as the basis for calculating the expenditures of energy as given in the following tables.

In making a comparable estimate of the expenditures of energy in milk production, the record of a Guernsey cow at the New York experiment station in 1891, appeared to answer the required conditions, as detailed statements of the composition of the food consumed and milk produced were given, and the dry substance of the milk for each month differed but little from the dry substance of the 100 pounds of increase in the fattening animals under consideration, indicating in a general way that nearly the same amount of work had been required in its production.

The factors used in estimating the potential energy of organic substances (based on experiments of Berthelot and

TABLE 2.

Expenditures of energy in fattening oxen, sheep and pigs, to produce 100 pounds of increase in live weight; and a similar estimate of the expenditures of energy in milk production. In foot-tons of work.

	Potential energy of total feed consumed.	Expended and stored in 100 lbs. of increase.	Lost in excreta including urea.	In repairs of the system and other physiological processes.
Oxen	3,389,929	413,558	955,790	2,020,580
Sheep	2,809,787	440,584	655,967	1,713,240
Pigs	1,269,181	457,800	175,674	635,699
"Analysed fat pig"	1,478,393	435,160	272,335	770,900
		In 557 lbs. milk.		
Guernsey Cow — April	1,610,800	329,390	581,573	699,840
		In 581 lbs. milk.		
Guernsey Cow — May	1,626,678	349,440	564,020	713,230

Andre, 1890) represent in round numbers the calories per pound of the proximate principles of foods and tissues as follows: proteids, 2500 calories; fats, 4200 calories; and carbohydrates, 1900 calories.

For convenience of comparison, the energy in the table is represented in its equivalent of foot-tons of work; the energy expended in raising a weight of one ton one foot.

Without an examination of other details this table would be misleading in its indications of the relative efficiency of the different classes of animals as machines for doing work. There are decided differences in the quality and quantity of feed consumed which should be taken into consideration, but we have no data for a quantitative estimate of the modifying influence of these different conditions which can only be noticed in general terms. For convenience of comparison the most important facts relating to feed consumed may be summarized in tabular form.

TABLE 3.

Kind and quantity of feed consumed by fattening animals to produce 100 pounds of increase in live weight, and feed of the cow for equivalent results in milk production.

	Dry substance of feed.	Dry substance of increase.	Proteids in feed.	Proteids in increase.	Feed Consumed.		
					Hay.	Grain.	Green feed.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Oxen	1109	68.6	218	9	600 (clover)	250 (oil cake)	3500 (swedes)
Sheep	912	72.5	177	7.5	300 (clover)	250 (oil cake)	4000 (swedes)
Pigs	420	73.8	52	7.0		500 (Barley meal.)	
"Analyzed fat pig"	478	71.4	100	7.7		1. Bran. 2. Bean and lentil meal. 3. Barley meal.	
Guernsey Cow April	469	78	82	19.2	300 (clover and timothy)	210 mixed grain	420 corn ensilage
Guernsey Cow May	510	83	81	21.5	182 (clover and timothy)	213 mixed grain	868 corn ensilage

To produce 100 pounds increase the oxen consumed more dry substance of food than the sheep, and of coarse fodder there was twice as much hay requiring a larger expenditure of energy to dispose of it, and a smaller amount was utilized and stored in the increase which contained less dry substance. There was also a larger loss in the excreta and a greater expenditure in repairs of the system and other physiological processes, resulting from the increased metabolism.

A comparison of tables 2 and 3 will show that less work is required to dispose of the smaller amount of coarse feed in the rations of the sheep, and with less dry substance of feed they give a much better proportionate return in increase than the oxen; while the pigs fed on barley meal alone make the same increase from less than one-half the dry substance of feed consumed by the sheep, with a diminished waste in excreta, and the repairs of the system and other physiological processes are carried on with a comparatively small expenditure of energy.

The fourth column of table 3 is, however, of special interest in relation to the processes of nutrition, and the difference in the results we have been discussing. One of the most marked results of proteid substances in the food, now recognized by physiologists, is to increase the metabolism of the system. From the small amount of proteid substance stored up in the increase of fattening animals, as shown in tables 1 and 3, an active metabolism of the system must be carried on to dispose of any considerable excess supplied in the food, as all that is digested and not retained in the increase is discharged by the kidneys in the form urea. The supply of energy to carry on the increased metabolism of the system arising from an excess of proteid food is, to some extent, however, immediately provided for in the heat liberated in its conversion into urea.

The oxen, with 218 pounds of proteids in their feed, give the smallest return in increase, the largest amount of waste in excreta, and decidedly more work is required in repairs of the system and other physiological processes resulting from the increased metabolism. The pigs fed on barley meal, with only

one-fourth as much proteid matter in their feed, have a decided advantage in utilizing energy in their increase, with less waste in excreta, and a comparatively small expenditure of energy is required to keep the machine in working order.

A comparison of the results with the pigs fed on barley meal and the "analyzed fat pig" with a highly nitrogenous diet, will furnish quite as striking an illustration of the influence of proteid food, as the conditions are less complex from the absence of coarse fodder in the rations.

The "analyzed fat pig" consumed more dry substance, and nearly twice as much proteid matter, to make 100 pounds increase in live weight as the pigs fed on barley meal alone, but less energy was utilized in its increase, containing less dry substance and decidedly more was lost in excreta and a larger amount was required in repairs of the system.

TABLE 4.

The energy of food consumed by different animals to produce a given increase is expended as follows, under conditions above noticed.

	In increase.	Lost in excreta.	In repairs and other physiological processes.
	Per cent.	Per cent.	Per cent.
Oxen	12	28	60
Sheep	16	23	61
Pigs	36	14	50
"Analyzed fat pig"	29	18	52
Guernsey Cow April	20	36	43
Guernsey Cow May	21	35	44

The pigs fed on barley meal with their comparatively simple organs of nutrition, require less dry substance of feed and less energy to make a given increase than the ruminants with their complex nutritive machinery and large amount of coarse fodder in their rations which they are fitted to utilize; but pigs and ruminants are alike in failing to give as large returns in profitable increase with an excess of proteids in their feed.

The results recorded in table 2 must then be attributed to differences in the working machinery of the animals themselves, and the modifying conditions of the relative amount of coarse fodder and proteids in the feed consumed, but with our present knowledge of vital activities the relative influence of these variable factors cannot be determined.

The expenditures of energy by different animals in different ways, given in table 2 in foot tons of work, are summarized in percentages of the energy of feed consumed in the following table for convenience of comparison.

In the last columns of tables 2 and 4, several well defined physiological processes are grouped together from the lack of data to discriminate between them, and they undoubtedly vary in the relative expenditures of energy required in them under different conditions. Without attempting an exhaustive enumeration of these processes, the following may be noticed as of the first importance from the work performed in their activities.

Constructive metabolism in the repair of tissues; vaporization of water exhaled by the lungs and skin; work of the involuntary muscles in respiration and circulation of the blood; energy expended in mental activities and the functions of secretion and excretion; loss of heat by radiation from the body; and work done by the voluntary muscles.

It will be seen from table 4 that the largest percentage of the available energy of foods is expended in these strictly physiological processes concerned in maintaining the integrity of the animal machine. Under the conditions of feeding experiments, with fattening animals and cows giving milk, but little mechanical work is done by the voluntary muscles, and the last item of our enumeration of physiological processes might have been omitted as insignificant in relation to the enormous expenditures of energy in the other normal activities of the system to which attention has been directed.

If mechanical work is done by animals, it must be at the expense of the energy that might, under other conditions, be expended in the manufacture of animal products, as the physiological processes enumerated above must all be provided for

in fattening animals and cows giving milk with a minimum of muscular exercise, as well as in the case of animals engaged in severe muscular work.

The energy expended in mental activities is of the first importance in its influence on the efficiency of the animal machine in useful work. The nervous system, through which mental endowments are manifest, has intimate relations with every part of the animal machine and the direction in which energy is expended is largely determined through its agency.

Practical farmers are well aware that animals fail to give profitable returns for feed consumed when restless and excited through any source of disturbance, or when dissatisfied with their feed and surroundings.

The available energy of a liberal supply of nutritious food may all be expended, and even the stored energy of the tissues drawn upon to carry on the increased physiological activities resulting from mental and nervous derangements of the nutritive machinery without any expenditure in profitable production. In conducting feeding experiments and in the interpretation of their results this is one of the most difficult factors to deal with, as it may have a dominant influence on the final outcome.

The approximate estimates of the relative efficiency of different animals in utilizing the potential energy of their feed in useful work, which have been given in mere outline, will require revision and correction as we become better acquainted with the specific influence of the variable factors of food and environment on the work performed by animal machines. Even in their present imperfect form they may, however, serve to illustrate the significance of energy as a factor in animal nutrition and the futility of formulating diets and nutritive ratios in terms of their chemical constituents.

THE BACTERIAL DISEASES OF PLANTS: A CRITICAL REVIEW OF THE PRESENT STATE OF OUR KNOWLEDGE.

By Erwin F. Smith.

(*Continued from p. 731*)

III.

Note.—A second note by Dr. Sorauer on the Bacteriosis of Fodder Beets adds a number of interesting items. This is entitled (***24a***) Die Gummikrankheit bei Runkelruben etc. It was published in *Jahrb. d. Deutschen Landwirtschafts-Gesellschaft.* Bd. 7, Berlin, 1892, Second part, pp. 206, 207, and was republished verbatim in *Zeitschr. f. Pflanzenkr.* 2Bd. 5Heft, 1892, pp. 280–281. The following abstract should therefore be read in connection with the *Remark* on p. 723 from which place the reference was inadvertently omitted.

Samples of the diseased beets were received from Vukovar in October, 1890 and in February, 1891. With the first specimens came the statement that one half of the crop was affected. The beets were drilled early in April and the weather was favorable until the middle of June; then hot and dry weather set in, continuing until harvest time in the middle of October. During all this time there was only one rain. The beets suffered severely from the heat and drouth, losing all their outer leaves and pushing new ones toward the end of September. At harvest time the disease was found more or less developed in such plants as showed wilted heart leaves. The blackening of the roots, a blue black, began at the lower extremity and continued upward after the roots were stored. The flesh of the root appeared to be uniformly blackened at the root tip, and from this part the discoloration radiated upward into the sound part so that at last it was noticeable only in the regions of the vascular bundles as brown stripes and rings, the rest of the flesh being white. On making a cross section of the beet root a drop of gum sometimes exuded within a few minutes from isolated points of the browned vascular strand. The affected beets became flabby and shriveled lengthwise and in places showed a sticky sweat or an abundant exudation of gummy masses through the uninjured surface, forming a lacquer-like covering. In bad cases gum cavities appeared in the flesh from solution of the tissues. The diseased beets contained a strikingly large amount

of grape sugar. This was determined by use of Barfold's reagent. Two milch cows fed on these roots died the second day. The symptoms were bloating, pain in the abdomen, obstinate constipation, and the prolonged vomiting of a tough yellow slime. In both cases pieces of the diseased beets were found in the first stomach along with other food, and no other reason for death was apparent. These beets (four varieties) were grown on a porous clay soil containing 5% lime and 8% humus. The soil-water level was 16 meters from the surface. The field had been very heavily dunged with stable manure.

II. THE HYACINTH (HYACINTHUS ORIENTALIS L.).

1. THE YELLOW DISEASE (1883).

(I) THE DISEASE.

(1) *Author, Title of Paper, Place of Publication.*—This disease was described by Dr. J. H. Wakker, as a result of investigations begun in the fall of 1881 at the request of the Algemeene Vereeniging voor Bloembollencultur te Haarlem, and was carried on in the laboratories of the University of Amsterdam. The first brief account appeared in 1883, in *Botanisches Centralblatt* (Bd. XIV, pp. 315–316) and forms part of a (**30**) Vorläufige Mittheilungen über Hyacinthenkrankheiten. The following year a more extended account was published in Dutch, (**31**) Het geel-of nieuwziek der Hyacinthen veroorzaakt door *Bacterium Hyacinthi* Wakker (*Onderzoek der Ziekten van Hyacinthen, en andere bol-en knolgewassen. Verslag over het jaar 1883.* Haarlem, August, 1884. 8vo, pp. 4–13, one colored plate). Two additional papers were published in Dutch, continuing and concluding the one above mentioned, (**32**) *Onderzoek etc., Verslag over het jaar 1884.* Haarlem, May, 1885, 8vo, pp. 1–11, and (**33**) *Onderzoek etc., Verslag over het jaar 1885.* Haarlem, May 1887, 8vo, pp. 1–5, and 27 to 37). These are the important papers to read and the ones which have mostly escaped mention. Finally, six years after the commencement of the investigation, Dr. Wakker published a fifth paper, entitled (**34**) Contributions à la pathologie végétale: I. La maladie du jaune, ou maladie nouvelle des jacinthes, causée par le *Bacterium Hyacinthi* (*Archives néerlandaises d. Sci. ex. et nat.*, tome XXIII, 1889, pp. 1–25, pl. I). This paper is merely

an abstract of the earlier Dutch papers. Part of the lithographic figures in the plate are, however, new.

Remark.—The papers published by Dr. Wakker in 1883 and 1884 were among the first contributions of any importance to the bacterial literature of plant diseases, but they were not, as claimed, actually the first. That honor belongs to this country, as we shall see later on when we come to take up pear blight, Prof. T. J. Burrill having published a long paper in 1880. The lack of literature and the difficulties in the way of the successful prosecution of this work at that time are well expressed in the *Verslag* for 1883: Als oorzaak van een plantenziekte waren Bacteriën nog slechts eenmaal en dot wel zeer kort (Prillieux *Bull. d. l. soc. bot. d. Fr.* 1879, p. 31 and 187) beschreven zoodat het geval van het geelziek niet alleen van praktisch, maar ook van hoog wetenschappelijk gewicht is. Is daarom het onderzoek er van zeker her belangwekkendste van alle ziekten, waarmede wij ons hier zullen bezighouden, het is ook tevens het moeilijkste omdat bij gebrek aan mededeelingen omtrent dit of een dergelijk onderwerp alles op eigen onderzoek berusten moet.

(2) *Geographical Distribution.*—This disease has prevailed extensively at times in the large bulb gardens in the Netherlands, where it is said by a majority of the Dutch horticulturists to be a new trouble, i. e., one that has appeared within the last ten years (**31**) or within the last 20 years (**34**). The writer of this digest has never been able to find the disease in bulbs imported from Holland, and does not remember to have seen any account of its occurrence in other parts of the world.

(3) *Symptoms.*—According to Dr. Wakker the first symptoms of the disease are usually in the foliar and floral organs. There is an apical browning or blackening of the leaves and scapes which color can often be traced downward into the green leaves for some distance in the form of dark stripes. The epidermis frequently ruptures longitudinally, and large irregular masses of bacterial slime exude from the rifts. The diseased parts also have a wet, unctuous appearance, and shrivel from the apex downward. Subsequently the bulbs become diseased, and clearly as a result of the preceding disease of the

foliar and floral organs. The earliest symptom of disease in the bulb consists on cross-section, of yellow dots, visible here and there in the interior of the scales or, on longitudinal section, of yellow lines which frequently extend into the plateau. From these spots, a mucilage swarming with bacteria can be obtained in drops by squeezing the scales or simply by exposing the cut bulb to the air. Sometimes the whole interior of the scale, or all of its inner or outer part, degenerates into a mass of yellow slime. If the attack is rapid, the plateau is soon invaded and the bulb rots in the ground during the fall or winter. If the progress of the disease is slow, and this is usually the case, the bulb sends up leaves and blossoms the following spring in the ordinary manner. At this time or afterwards there are distinct signs of the disease. In many cases the leaves turn yellow in lines parallel to the longer axis of the leaf. These lines begin at the base of the leaf and proceeding upward become less and less visible until they entirely disappear. In the interior of the leaf under these yellow stripes the bacterial slime is abundant and on the lower parts of the leaf it frequently finds its way to the surface, ruptures the epidermis and escapes. In such plants the bulb is always badly diseased, especially the outer scales which are the basal portion of the leaves of the previous year, and this, taken in connection with the fact that the bulbs are entirely sound in most cases where the symptoms are only visible at the apex of the leaf, renders it very probable that the latter is to be regarded as the first stage of the disease and the former as a later stage, supervening the second year. Another symptom, sometimes observed the second year, is unequal growth, i. e., a distinct curving over of the foliage toward that side of the plateau which has perished or is no longer capable of furnishing the proper supply of water and nutrient substances, the curvature being, of course, due to the one-sided growth. As a rule, diseased bulbs do not produce many bulblets, and not all of the latter are always diseased. If planted out, those which are diseased show signs of the malady in the young plants after a longer or shorter period. The leaves turn yellow, become flabby and droop, or show the characteristic longitudinal rifts in the epidermis. When such

young bulbs are cut, the plateau (central short stem of the bulb) is often found to be the only diseased part, something inexplicable if we do not admit that the disease has been transmitted to the bulblet from the mother bulb. Such is the usual form of the disease, but it will be understood that there are numerons modifying circumstances, the disease sometimes beginning lower down on the edge of the leaf, or even underground, or progressing more rapidly, the latter especially when the disease attacks full grown leaves and scapes. The most cases of the first stage of the disease are noticed in the field in May, but cases also occur much earlier in the year.

(4) *Pathological Histology.*—In spring, in the first stage of the disease, when only the tips of the leaves are attacked, microscopic examination shows the bacterial slime to be present in the intercellular spaces of the shrivelling leaf-parenchyma, but always only in small quantity. From this part of the leaf the bacteria may be traced long distances down the vascular bundles, but have not yet reached the bulbs, the latter being still entirely sound. In autumn, on the contrary, cross sections of the bulbs, if not too badly diseased, show numerous yellow dots in the scales, and on microscopic examination these are found to correspond to the xylem part of the vascular bundles (No. **34**, pl. I, figs. 9, 10). The vessels of the latter are seen to be full of a thick, yellow slime, which often partially dissolves them. Here and there, the whole xylem part of the bundle may disappear, the yellow slime taking its place. In this way are formed continuous, tubular cavities, filled with isolated cells of the host plant, remnants of spiral threads, and an innumerable number of bacteria. In this stage of the disease, the sieve tubes are not yet attacked, but these are subsequently destroyed, and frequently, also, the parenchymatic tissues outside of the bundles, the substance which unites the cells being first dissolved. The second spring, a microscopic examination of the yellow striped leaves from diseased bulbs shows a similar occupation of the vessels with the same lesions, but in a reverse order, the bacteria being most abundant and the destruction of tissues greatest in the basal part of the leaf. Here the bacteria dissolve the walls of the vessels

and make their way into the surrounding tissues, first isolating and then destroying the parenchymatic cells and finally increasing to such an extent that the epidermis is ruptured and a viscid, yellow ooze escapes. The vessels of the scape are filled in the same way, but the bacterial slime was not observed in the roots. The bacteria may be distinguished in the vessels considerable distances in advance of any external or macroscopic symptoms. The bacterial mucilage is a yellow liquid, thick and viscid. Under a low power of the microscope it shows a granular structure, this being due, as we recognize on higher magnification, to the presence of bacteria. Dr. Wakker describes at some length his method of examination: "The transverse sections must be made with extreme care, such as is almost unknown in the ordinary study of vegetable anatomy. Not only is the affected tissue so soft that it is impossible, in a fresh state, to cut sections sufficiently thin, but there is also danger that the mucilage will be dragged by the knife into parts of the leaf where originally there was not a trace of it. To overcome these two difficulties good use was made of absolute alcohol. The green color was removed by this method while the yellow of the mucilage persisted, and, in consequence, became much more distinct, so that it was easier to distinguish diseased from healthy tissues."

(5) *Direct Infection Experiments.*—This disease was studied before Koch's plate method of isolation had come into general use, and most of the infection experiments were made directly from diseased to healthy plants. In the fall of 1882 bacteria were introduced into a bulb of the double white Anna Maria, and when this bulb was cut the next spring it showed distinct signs of the disease. This experiment was frequently repeated and always with the same result. For example, the whole cut surface of the scales of a bulb from which roots and leaves were cut away in summer was smeared with the bacterial slime, and in 14 days the disease was to be found in the vascular bundles of the youngest scales, and shortly after in those of the older. Slightly diseased bulbs are the best parts from which to obtain the bacteria. In badly diseased plants one runs the danger of finding all sorts of things, even Penicillium, in the de-

cayed mass; and from the leaves, before the disease has reached the bulb, it is impossible to get a sufficient quantity of the slime.

On March 27, 1884, small quantities of yellow slime were taken from some slightly affected bulbs (double red Temple of Apollo) and inserted into wounds made for this purpose in the top of the leaves of different varieties. These were examined daily for signs of disease which first appeared, in most cases, only after a month. Distinct symptoms were apparent but unfavorable circumstances caused the loss of the leaves before the downward stripe had progressed very far. These plants stood in pots in the open air and were watered regularly, but the spring was very dry. Although in this case a month elapsed before external symptoms appeared, it is not to be inferred that so long a time always intervenes. On the other hand it is likely that in natural infections even a longer time may elapse before symptoms appear, since countless numbers of the bacteria are used in artificial infections, while natural infections are probably brought about in most cases by the entrance of a few bacteria which would require more time to produce visible results. On Oct. 27, 1884, the small unfolding leaves of each of a number of sound hyacinth bulbs were wounded with a steel pen and some of the bacterial slime inserted into these punctures. The bulbs were then potted, kept in a place free from frost and examined from time to time. On Jan. 13, 1885, one plant showed the disease very distinctly. Two of the three infected leaves had stripes extending downward from the wound, each about 13 mm. Here, also, a long time intervened between the inoculation and the appearance of external symptoms.

Another series of infection experiments was begun Dec. 28, 1885, and completed in the spring of 1886. These plants were also inoculated with bacterial slime taken directly from diseased plants. These experiments were made on five plants of as many varieties, grown in carafes. All were kept in a cool place until Feb. 13, when they were transferred to a room regularly warmed. The manner of inoculation and the results obtained are here summarized: *La Tour d'Auvergne* (double

white variety). Bacteria introduced into a wound in the yellow part of a leaf. *Results:* Feb. 13. In bloom. Two small streaks extending downward from the wound. Feb. 20. Leaf accidentally broken. It was put immediately after into alcohol and subsequently hardened in absolute alcohol, whereupon microscopic preparations made and stained in the way already described, showed three vascular bundles attacked in varying degrees. Two of them evidently corresponded to the two little stripes on the leaf, while in the third bundle the disease had not made enough progress to be visible on the surface of the green leaf. *Norma* (single red variety). Bacteria introduced into the green tips of three leaves. *Results:* Feb. 13. In bloom. 1st leaf, nothing. 2nd leaf, a little spot two millimeters above the wound. 3rd leaf, a similar spot below the wound. Feb. 20. No change. Feb. 27. No change. March 6. No change. March 20. Second leaf broken; 3rd leaf show little spots 10 mm. below the wound, plant moved into the open air. March 27. No change. April 3. No change. *Coeur blanc* (single white variety). Bacteria introduced into a wound in the yellow part of a leaf. *Results:* Feb. 13. A stripe extending downward from the wound, 4 mm. Feb. 20. In bloom. No change. Feb. 27. Length of stripe 15 mm. March 6. Length of stripe 22 mm. March 13. Length of stripe 25 mm., and small spots 10 mm. lower. March 20. Length of stripe 27 mm., and small spots 22 mm. lower. Plant put into the open air. March 27. Length of stripe 27 mm., and small spots 35 mm. lower. April 3. Length of stripe 67 mm. *Crown Prince Charles of Sweden* (double blue variety). Bacteria put into wounds at the green apex of two leaves. *Results:* Feb. 13. Nothing. Feb. 20. 1st leaf, a downward stripe of $3\frac{1}{2}$ mm. from one of the wounds. 2nd leaf, nothing. Feb. 27. 1st leaf, length of stripe 15 mm., and small spots all around the wound. 2nd leaf, nothing. March 6. In bloom. Length of stripe 17 mm. March 13. Length of stripe 18 mm., and a small spot 4 mm. lower. March 20. Very little change. Plant put under a bell jar on a dish containing water. March 27. Length of stripe 22 mm. Bell jar removed because leaf began to turn

yellow. April 3. No change. *Anna Maria* (double white variety). Fragments of diseased tissue introduced into wounds in the green tips of three leaves. *Results:* Feb. 13. A downward stripe from one of the wounds, length 10 mm. On the other two leaves nothing. Feb. 20. In bloom. Length of stripe, 17 mm. On the other two leaves nothing. March 6. Length of stripe 35 mm., and small spots 10 mm. lower. March 13. Length of stripe 45 mm. The stripe and bordering tissues have dried up for a distance of 35 mm. March 20. Length of stripe 55 mm., and small spots 15 mm. lower. Diseased part dry for a length of 50 mm. Leaf bent by the drying of one side. Plant put out-doors. March 27. Length of stripe 90 mm. Dry for a length of 55 mm. April 3. Length of stripe 94 mm.

Measurements were not made after April 3, but subsequently all of the diseased leaves were removed, placed in alcohol, hardened in absolute alcohol, and examined microscopically in the same manner as the leaf already mentioned, and with the same result. On the same date, Dec. 28, 1885, a quantity of bulbs, including the above varieties, were also infected and were planted out of doors where they were exposed freely to the air. Up to April 3 there were no signs of disease but a little later symptoms appeared in most of the plants. From these experiments the author draws the following conclusions: (1) the *Geelziek* or *maladie du jaune* can be induced artificially, and (2) the results of the infection make their appearance a long time after the operation.

(*To be continued.*)

EDITOR'S TABLE.

THE late meeting of the American Association for the Advancement of Science while less numerously attended than some others, was a larger gathering than has sometimes represented it. The meetings of the Association cannot be as large relatively to our population as those of most of the European nations, because of the longer distances which the members are compelled to transverse in order to reach them. Many of the most active workers must always be absent in the field during the summer months, especially so long as our country presents such opportunities for original research. The summer schools take away some members. The meeting at Buffalo was held in such a way as to discourage the attendance of those who regard it as merely an opportunity for junketting. The meetings extended from Monday to Friday inclusive, and Saturday only was reserved for excursions. This arrangement was greatly to the advantage of work, the maintainance of interest, and of the attendance. The members present were more than usually conspicuous as workers, and the number and value of the papers read was fully up to the best standard.

The Association decided to meet in Detroit at the unusually early date of August 9th, next year. This date was fixed on account of the approaching meeting of the British Association at Toronto on August 18th following. A cordial invitation from the citizens of Toronto to take part in the reception of the British Association was accepted, and this will follow the meeting at Detroit.[1] A respectable minority of the Association thought that we should suspend our meeting for that year, or meet formally for organization only, and then adjourn to take part in the reception of the British Association. This view carried the Nominating Committee, but was not approved by the Association. That the Association did wisely there can be no doubt, and the circumstance shows that all the wisdom in that body is not concentrated in its representatives in the Nominating Committee. The reasons put forth by the Committee for its action were plausible, but were believed to be fallacious by a large majority of the Association. One of these reasons was the assumption that the American Association meeting would necessarily be neglected by its members if the British Association meet in Toronto. The Association thought otherwise, especially as it was remembered that the second largest meeting ever held was in

[1] Not however by special adjournment as stated in Nature of Sept. 17, p. 480.

Philadelphia in 1884 when the British Association met in Montreal. As the American Association knows its own mind, we may look for one of our largest meetings in Detroit in 1897.

In our issue for October, 1895, we referred to the organization of the Field Museum of Chicago as having failed to furnish a successful basis of operations for the prosecution of original research. At that time most of the men who could give reputation to it had left, owing to the unsatisfactory positions in which they found themselves placed. Subsequently the establishment of publications of a very meritorious character induced us to believe that proper steps had been taken by the management to place the scientific men on such a basis as to insure the future prosperity of the enterprise. Authentic information recently received shows that this anticipation was premature. Other resignations have occurred, and the institution is evidently destined to be a failure unless a reorganization is effected.

Men who have spent their lives in mercantile pursuits are generally unacquainted with the conditions necessary to original research in science. The modus operandi in the two pursuits is fundamentally different. An element of tentative experiment enters into the pursuit of science, which requires a degree of freedom on the part of the investigator which cannot be accorded to the regulai employee, the results of whose work are always susceptible of full anticipation. The investigator must have full control of material of research and of the ways of getting it. In fact no one else is likely to know how to get it. He alone knows the profitable lines of work; hence he must be permitted to select his work. No one will secure a museum sooner than he, and it will be as much more valuable than can be created by any one else, as the work of an expert is necessarily more important than that of other persons. For these and many other reasons no museum can become great unless its administration is in control of scientific experts, who should be responsible to each other and to the trustees only. With an organization of this kind, composed of the class of men from whom it has already selected some of its aids, there is no reason why the Field Museum, under the liberal terms of its endowment, should not rival the greatest museums of the world.

—We must again remind contributors to the Naturalist that proofs of all kinds and blocks of engravings must be sent to the publishers and not to the managing editor. Failure to observe this rule often causes inconvenient delays. Manuscripts, on the other hand, should go to the appropriate editors, and not to the publishers.

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General Notes.

MINERALOGY AND CRYSTALLOGRAPHY.[1]

Development of Faces on Crystals.—Gaubert[2] makes a contribution to the subject of the growth of crystal faces by means of his experiments with the alums. An octahedron of chrome alum, on solution in its mother liquor, is rounded at its edges and angles. When the solution becomes again saturated, and the crystal begins to grow, faces of the forms (100), (110), (211) and (221) are developed, but disappear on continued growth, leaving finally only the octahedron (111). Experiments with crystals of chrome and potassium alum prove that the same faces are developed when the rounding is done mechanically instead of by solution. Potassium alum from pure water gives the form of octahedron and cube, but by rounding (211) and (221) may be caused to grow.

[1] Edited by Prof. A. C. Gill, Cornell University, Ithaca, N. Y.

[2] Bull. Soc. Fr. Min., XVIII, pp. 141–143, 1895.

Crystals of lead nitrate and of barium nitrate also develop transitory faces when rounded, returning to the original form of cubo-octahedron on continued growth. Miers has observed the formation of the face (221) by the extremely slow solution of the potassium alum crystals. Hence, it seems that these "transitory planes" may be formed either by corrosion or by growth of a rounded crystal.

Albite from Lakous, Island of Crete.—Viola,[3] by his paper on the new occurrence of albite at Lakous, adds another to the list of carefully investigated pure chemical substances. An analysis by Mattirolo, given at the end of the article, shows close agreement with the theoretical values for $Na\ Al\ Si_3O_8$ as may be seen from the following:

	Found.	Theoretical.
SiO_2	68.35	68.70
Al_2O_3	19.78	19.47
Na_2O	11.71	11.83
K_2O	.16	
Ign	.15	
	100.39	100.00

Measurements on twelve crystals, varying from 7½ to 20 mm. in diameter, agree very well in giving as crystallographic constants: $\alpha = 94° 14' 30''$, $\beta = 116° 31' 45''$, $\gamma = 88° 5' 1''$, and $\breve{a} : b : \dot{c} = .635 : 1 : .557$. The extinction angle measured against the trace 001 in a section cut parallel to 010 is 21° 30′, in the section 001 it is 3° 30′. The optical angle is approximately + 80°. Inclusions of a member of the chlorite group are found in a number of the crystals, and some small scales of hematite in others.

Forsterite from Monte Somma.—The specimens seem to be of unusual chemical purity, hence the data given by Arzruni[4] on the the basis of investigations by himself, Jolles and Thaddéeff are doubtless near the true values for pure $Mg_2\ SiO_4$. The axial ratio is found to be $a : b : c = .46663 : 1 : .58677$. Cleavage parallel to 010, distinct. In addition to the previously observed method of twinning, the plane 031 is reported as a twinning plane.

[3] Tscherm. Mitth., XV, pp. 135–158, 1895.
[4] Zeitschr. f. Kryst., XXV, pp. 471–476.

The plane of the optical axes is the base, and the optical angle is 85° 38′ for lithium, 85° 45′ for sodium, and 85° 56′ for the thallium light.

The results of analysis are:

	I.	II.
SiO_2	42.65	42.39
FeO	1.35	3.12
MgO	56.57	55.09
CaO	.29	
Al_2O_3		.23
	100.86	100.83
Sp. G.	3.223	3.245

The ratios $RO : SiO_2$ are 2.018 : 1 and 2.01 : 1 respectively, after deduction for probable impurities.

Fayalite and the Chrysolite-Fayalite Group.—Penfield and Forbes[5] found the fayalite from Rockport, Mass., suitable for optical and other investigations. The mineral was found in the shape of a lenticular shell in massive hornblende-biotite granite. The color is a dark resinous green, though the light transmitted by the thin edges is yellowish. The purified powder has a specific gravity of 4.318 (average of 3 determinations). The average of the two analyses is:

SiO_2	30.08
FeO	68.12
MnO	.72
H_2O	.80
	99.80

The cleavages are 001 and 010, and the reported occurrence of a cleavage 100 is considered a mistake.

The plane of the optical axes is the base, and the double refraction is negative. For sodium light. $\alpha = 1.8236$, $\beta = 1.8642$, $\gamma = 1.8736$, giving $\gamma - \alpha = .050$. The macro-axis is the acute bisectrix, $Vy = 25°$ 18′.

A specimen of hortonolite from Monroe, N. Y., was also investigated. The table given below exhibits at a glance the effect of the iron on the optical characters of the chrysolite-fayalite group:

[5] Am. Jour. Sci., CLI, pp. 129–135, Feb., 1896.

	% FeO	2 V (over α)	β
Fayalite Rockport,	68.1	49° 50′	1.864
Hortonolite Monroe,	47.3	69° 24′	1.791
Chrysolite, Auvergne,	13.0	89° 36′	1.692
Chrysolite, Vesuvius,	12.6	89° 42′	
Chrysolite, Hawaii,	10.3	91° 2′	
Chrysolite, Egypt,	9.2	91° 19′	1.678
Chrysolite, N. M.,	8.6	91° 24′	
Chrysolite, Unknown,	?	92° 14′	1.678
Chrysolite, East Indies,	?	92° 45′	1.670
Forsterite, Vesuvius,	2 (?)	93° 50′	1.657

At about 12% FeO, therefore, the optical character changes from positive to negative.

Rhodophosphite and Tetragophosphite.—The rare mineral locality at Horrsjöberg in Wermland, Sweden, is the source of these two new minerals recently described by Igelström.[6] The rhodophosphite occurs in large quantities in layers reaching a thickness of 2½ feet, so that it can be mined profitably. At one locality it is found in the form of hexagonal prisms. From the partial analysis, it appears to be chiefly a calcium phosphate, with considerable quantities of ferrous iron and manganese, also chlorine, fluorine, and sulphuric acid. The formula proposed is $20\ (RO)_3\ P_2O_5 + 4\ (Ca\ Cl_2, CaF_2) + Ca\ SO_4$, where R = Ca, Mn, Fe, or Mg. The mineral is allied to svanbergite.

Tetragophosphite occurs in "four-sided" plates, or as a coating on the containing cyanite-damourite rock. The two analyses are:

P_2O_5	36.92	33.64
Al_2O_3	40.00	41.81
FeO, MnO	9.51	9.51
MgO, CaO	7.50	6.74
H_2O	5.96	8.30

These lead to the formula $(Fe, Mn, Mg, Ca)_3\ P_2O_8 + (Al_2O_3)_3\ P_2O_5 + 3H_2O$. It is somewhat lighter blue than lazulite, which it seems here to replace. The "Gusblatt-phosphat" (light blue phosphate) from the Westana Mts., Prov. Skane, Sweden, analyzed by Blomstrand in 1868 seems to be undoubtedly the same mineral. He assigned the formula $(Ca, Mg)_3\ P_2O_8 + (Al_2O_3)_3\ P_2O_5 + 3H_2O$.

[6] Zeitschr. f. Kryst., XXV, pp. 433-436, 1895.

Miscellaneous Notes.—Von Zeynek[7] notes the occurrence of sulphur deposited in the canals carrying 1,000,000 gallons of water per day from the hot springs at Warasdin-Töplitz in Croatia.—Rohrer[8] gives results of two very careful analyses of hematite from Elba. The average of the two is as follows: SiO_2 .49, Fe_2O_3 98.60, CaO .42, MgO .74, total 100.25.—In an article on the contact of minerals of the Adamello Group of mountains in South Tyrol, Salomon[9] gives a detailed discussion of the Wernerite from Breno, with much of the literature relating to that mineral.—Duparc and Stroesco[10] have recorded the results of their observations on the crystalline form and optical behavior of thymoquinone and eleven of its derivatives.—Gentil[11] describes the occurrence of large bundles of yellowish-white somewhat altered sillimanite needles in pegmatite from Algeria. Veins of albite and plates of muscovite are also mentioned. The same author[12] makes a note of thomsonite, stilbite and analcite from an altered basic volcanic rock occurring near Dellys in the province of Algiers.—De Gramont[13] is led by the observation of the electric spark between fragments of certain minerals which are good conductors of electricity, to a study of the spectra of the sparks thus produced. This method promises to be useful for the rapid determination of certain minerals, and for the detection of included substances which are present only in traces. The lines of the non-metallic, as well as of the metallic elements may be observed. De Gramont also describes the apparatus used by him, and gives the details concerning the spectra obtained from air from twenty-four of the elements, and from about a hundred minerals.—Termier[14] calls attention to the two forms of the dimorphous substance PbO. After discussing the optical and crystallographic properties of the orthorhombic modification, he shows that its crystals are grouped to imitate a higher symmetry. PbO is, therefore, a good example of a substance which not only shows pseudo-symmetry by the grouping of the separate crystals, but also appears in a second form in which the *molecular* grouping follows an allied higher symmetry.—Gonnard,[15] in an article on French

[7] Tscherm. Mitth., XV, p. 192, 1895.
[8] Tscherm. Mitth., XV, pp. 184–187, 1895.
[9] Tscherm. Mitth., XV, pp. 159–183, 1895.
[10] Bull. Soc. Fr. Min., XVIII, pp. 126–141, 1895.
[11] Bull. Soc. Fr. Min, XVIII, pp. 170–171, 1895.
[12] L. c., p. 374.
[13] Bull. Soc. Fr. Min., XVIII, pp. 173–373, 1895.
[14] Bull. Soc. Fr. Min., XVIII, pp. 376–380, 1895.
[15] Bull. Soc. Fr. Min., XVIII, pp. 382–390, 1895.

siderites, adds to the thirteen forms of that mineral previously known the three rhombohedra (0332), (30$\bar{3}$4), and (1012).—Termier and Richard[16] conclude from their study of crystals of $Ca_4P_2O_9$ occurring in the slags of the iron works at Kladno, that they are pseudo-orthorhombic, composed of monoclinic lamellæ. Measurements of the apparently orthorhombic form agree well enough with those of Miers to show that both had to deal with the same substance. The specific gravity is 2.93–3.1, mean index of refraction, about 1.64. For red light, 2 V = 20° (?), and for blue light it is about 40°.—O. Nordenskiöld[17] finds edingtonite from Bôhlet, Sweden, to be orthorhombic hemihedral instead of tetragonal hemihedral, as previously supposed. Sp. G. = 2.776, plane of optical axes = 010, negative bisectrix parallel to the vertical axis, 2 V for lithium light = 52° 47′, for sodium = 52° 55, and for thallium 53° 10′. The indices of refraction for the above kinds of light are also determined. The mean index for sodium light is 1.5492, and the double refraction is .016. In conclusion, the similarity of form with that of mesotype is shown by the axial ratios:

Edingtonite a : b : c = .9872 : 1 : .6733

Mesotype a : b : 2c = .9785 : 1 : .7072

—Goldschmidt[18] figures and describes a projection goniometer by means of which the position of crystal faces is projected directly upon paper, thus doing away with the reading of angles and with trigonometrical computation. The instrument seems to be in many ways convenient, but does not give the highest degree of accuracy. A contact goniometer of similar action is also briefly mentioned.

PETROGRAPHY.[1]

Geology of Point Sal, California.—The geology of Point Sal, the extreme northwestern corner of Santa Barbara County, California, has been carefully worked out by Fairbanks[2] with special reference to the igneous rocks found there. The sedimentary rocks constituting the point and the adjacent country are of miocene or later age. They

[16] Bull. Soc. Fr. Min., XVIII, pp. 291–295, 1895.

[17] Bull. Soc. Fr. Min., XVIII, pp. 395–398, 1895.

[18] Zeitschr. f. Kryst., XXV, pp. 538–560, 1895.

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. Dep. Geol. Univ. of Cal., Vol. 2, p. 1.

comprise volcanic ashes, gypsiferous clays and bituminous shales, the last named of which were regarded by Lawson as tuffs. The present author declares them to be organic deposits. The igneous rocks which penetrate these beds are all basic. They include gabbros, peridotites, basalts, diabases and rocks similar to those heretofore described as analcite diabases. These latter are all now considered by the author as representing the otherwise practically unknown type of the teschenites. The augitic variety of this rock has the general structure of the diabases, in which are large poikilitic plates of augite. Between the diabasic constituents are polyhedral grains of analcite, and, in what appear to have been cavities in the rock-mass, are little groups of crystals and crystalline masses of the same mineral. The plagioclase in the rock is all zonal with nuclei of labrodorite surrounded by concentric zones of a more and more acid feldspar, the peripheral one being albite. An analysis of a coarse grained specimen gave:

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	P_2O_5	Ign.	Total
49.61	19.18	2.12	5.01	10.05	4.94	1.04	5.62	.27	3.55	=101.39

which corresponds very nearly to 43.3 per cent feldspar, with a density of 2.57, 32.3 per cent augite, 20 per cent analcite, 4 per cent magnetite and .04 per cent apatite. All of the analcite is supposed to be an alteration product of nepheline.

The basalts of the region include two types. One is the usual variety and the other an amygdaloidal and spheroidal variety that is intruded by diabases and diabasic gabbros. These last named rocks grade into one another. Both contain hornblende, some of which is regarded as secondary and some as primary. In addition to the diabasic-gabbros there are others associated with peridotites (and serpentines) in such a manner that both rocks are regarded as differentiated products of the same magma. The gabbro is sometimes massive. At other times it is possessed of a gneissic structure, often attended by a striping produced by the alternation of augitic and feldspathic bands. The structure is concluded, after study, to be the result of stretching.

Among the other basic rocks identified in the gabbro-peridotite complex are anorthosites, diorites, norites, lherzolites, picrites, saxonites, wehrlites, dunites and pyroxenites. Each type is well described and a discussion of the banding noticed in many of them is given in some detail.

Leucite-Basanites of Vulcanello.—After studying carefully the rocks on Vulcanello in the Lispari Islands, Bäckström[3] concludes

[3] Geol. För. i Stockh. Förhanl., XVIII, p. 155.

that the greater portion of them are leucite-basanites. They all contain phenocrysts of augite, labradorite, olivine and magnetite in a groundmass which is sometimes a holocrystalline aggregate of oligoclase, orthoclase, leucite and magnetite, and at other times of numerous leucites, small augites and iron oxides in a glassy matrix. The rocks are regarded as effusive types of lamprophyres (minettes or kersantites) a supposition which is the more probable from the fact that the effusives in the Lipari province are mainly feldspathic basalts, andesites, liparites and trachytes. Biotite and leucite are thought to be complementary minerals—the former separating from a siliceous magma under considerable pressure, and the latter from a magma of the same composition under surface pressure, under conditions favorable to the escape of the mineralizers fluorine and water. Leucite is not confined to rocks rich in potash, nor is it necessarily characteristic of these. Its place may often be taken by biotite.

A Squeezed Quartz-Porphyry.—A squeezed quartz-porphyry is described by Sederholm[4] as occurring at two places in the Parish of Karvia in Province Abo, Finland. In both it appears as dykes cutting granite. The rock consists mainly of microcline phenocrysts to which are often added growths of new microcline in optical continuity with the original crystals, phenocrysts of an acid plagioclase surrounded in many cases by microcline substance and quartz phenocrysts in a groundmass of orthoclase and quartz. The twinning of the microcline is more largely developed around quartz enclosures in the phenocrysts and near quartz veins than elsewhere in the crystals. The porphyritic quartzes occasionally retain their dehenhedral contours, but usually they are much deformed in outline and in their optical characteristics. Often the quartzes are so shattered that they now constitute lenticular areas of a quartz mosaic. The structure of the groundmass is in several types. In the most important one it consists of a micropegmatite of orthoclase and quartz containing shreds of chlorite, which in some cases are distributed so as to exhibit a fluidal arrangement. The granite through which the porphyry cuts is a coarse grained porphyritic variety composed of oligoclase, biotite and hornblende. On the contact with the dyke rocks it is crushed and much epidote is developed in it. Under the microscope it presents the usual aspects of a dynamically metamorphosed rock. In his discussion concerning the name to be applied to the porphyry, the author quotes from a letter by Dr. Williams in which the prefix 'apo' is defined as signifying that the rock

[4] Bull. Com. Geol. d'Finlande, No. 2, 1895.

to which it refers has been changed from its original character through devitrification.

Mica-Syenites at Rothschonberg.—Two dykes of mica-syenite cut the phyllite formation near Rothschönberg, Saxony, producing in the neighboring rocks contact metamorphism. One of the dykes weathers spheroidally, and in the kernels of the spheroids fresh material for study was afforded Henderson,[5] who found the rock to be composed of orthoclase, plagioclase, quartz, biotite, apatite and several accessory components. The feldspar and quartz both occur in grains and in crystals, the biotite in flakes. An analysis of the rock gave the figures below (I).

The second occurrence differs little from the first. Muscovite is present as well as biotite, otherwise the two rocks are practically alike in mineral composition. Its chemical composition is shown in (II).

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	H_2O	CO_2	S	Total
I.	61.40	16.66	7.46	2.08	3.65	2.93	4.75	.76	1.54	.20	=101.43
II.	57.63	16.47	5.37	5.25	4.44	3.12	5.15	.45	2.14	.95	=100.97

The structure of both rocks was panidiomorphic, although the development of secondary quartz renders them now hypidiomorphic. They are syenitic aplites. In the neighboring phyllites new biotite has been abundantly developed and hornblende has been produced in some quantity. The free silica which is abundant in the unaltered phyllites has become combined with metallic elements in the altered forms. While the percentage of silica in specimens taken at 2 meters and 11 meters from the contact and at the contact is the same, the free quartz in the first is 43.38 per cent of the rock's mass, in the second 38.94 per cent and in the third 34.06 per cent.

GEOLOGY AND PALEONTOLOGY.

Cambrian Rocks of Pennsylvania.—During the years 1892 and '93, Mr. Walcott made an examination of the rocks of Cambrian southeastern Pennsylvania for the purpose of determining whether the lower quartzites with their superjacent limestones were of the same geologic age, in the areas included between the Potomac and Susquehanna and the Delaware and Susquehanna Rivers. The results of his work are published in bulletin form by the U. S. Geological Survey.

[5] Zeits. d. geol. Ges., XLVII, p. 534.

Mr. Walcott began the investigation in York County, where he determined the stratigraphic position of the Chickies quartzites and the York shales which are subjacent to the Lancaster (York Frazer) limestone. Paleontologic evidence shows them to be of Lower Cambrian age. The fauna of the main body of the limestone of York County, as shown by collections from three separate localities, is Cambrian. These localities indicate respectively, an Upper Olenellus zone, a horizon between the Lower and Middle Cambrian, and a lower horizon of the Middle Cambrian.

The discovery of Lower Cambrian fossils in the compressed syncline of limestone in Lancaster County, south of Columbia, indicates that the limestone on the west side of the river is of the same geologic age, and that the shales and schists beneath it are of Lower Cambrian age.

Mr. Walcott states that in York County there is no sedimentary rock other than the mesozoic new red sandstone—of later age than the Cambrian, unless it be the Peach Bottom slates and chlorite-schists of the southeastern corner of the country. He also thinks it probable from the closely related structure of Lancaster County that all the Lancaster limestones will fall within the Cambrian, unless it be some portions of the upper series, which may pass into the Ordovician. He applies this generalization to the entire extension of this series of limestone northeastward to the Delaware.

All of the quartzites that have been referred to the Potsdam necessarily fall into the Lower Cambrian, as they are beneath the limestones.

The South Mountain chain, as stated by Professor Lesley and Dr. Frazer, consists of two groups of rocks, a quartzite and an orthofelsite series, the latter being considered the superior series. Mr. Walcott's investigations lead him to a different interpretation of the geologic structure of the mountain and the relations of the rocks composing it. He finds that the "orthofelsite" is in reality the lower series, and that the complicated structure of the mountain arises "partly from folding, but more largely from the westward thrusts of masses of strata along the lines of fault of a low hade. This westward thrusting on the fault plane, complicated by previous folding of the strata, leaves masses of the subjacent, pre-Paleozoic rocks resting in various places on different members of the Lower Cambrian series, and also appears to interbed the quartzites and schists of the Cambrian in the schists, eruptives, etc., of the Algonkian."

The following are the concluding remarks in the section on Correlation :

"The discovery of the Olenellus or Lower Cambrian fauna in the Reading sandstone practically completes the correlation of the South Mountain, Chickies and Reading quartzites, and establishes the correctness of the early correlations of McClure, Eaton, Emmons and Rogers. They all considered the basal quartzite as the same formation from Vermont to Tennessee; and the discoveries of recent years have proved that the basal sandstones of Alabama, Tennessee and Virginia (Chilhowee quartzite); Maryland, Pennsylvania and New Jersey (Reading quartzite); New York and Vermont (Bennington quartzite), were all deposited in Lower Cambrian time, and that they contain the characteristic Olenellus fauna throughout their geographic distribution. The superjacent limestones carry the Olenellus fauna in their lower portions in northern and southern Vermont, eastern New York, New Jersey and Pennsylvania. To the south of Pennsylvania the lower portions of the limestones appear to be represented by shales, and the Upper and Middle Cambrian faunas are found in the lower half of the Knox dolomite series of Tennessee, and they will probably be discovered in the same series in Virginia and Maryland when a thorough search is made for them. The same may be predicted, but with less assurance, for the northern belt of limestone crossing Pennsylvania into New Jersey as the limestones between the Olenellus zone and the Trenton zone represent the intervals of the Middle and Upper Cambrian and the Lower Ordovician, or the Calciferous and Chazy zones of the New York section."

Nothing was discovered upon which could be based a line of demarcation between the Cambrian and Ordovician linestones in the series under discussion. The division is still an open question to be decided by future revelations of lithologic and paleontologic characters. (Bull. U. S. Geol. Surv., No. 134, Washington, 1896.)

Structure of Uintacrinus.—Since Uintacrinus was first made known by Grinnell, some twenty years ago, little notice has been taken of the form. Of late, however, special interest in the type has been revived, and the form comes in for consideration in several important articles. Among them are W. B. Clark's review of the Mesozoic Echinodermata of the United States[1], in which all known material is described, and the structure amply illustrated by figures. Shortly after Williston and Hill[2] gave some "Notes on *Uintacrinus socialis*" as found in Kansas. Still more recently Bather[3] has gone over all the

[1] U. S. Geol. Sur., Bull. 97, pp. 21–24, 1893.

[2] Kansas Univ. Quarterly, Vol. III, pp. 19–21, 1894.

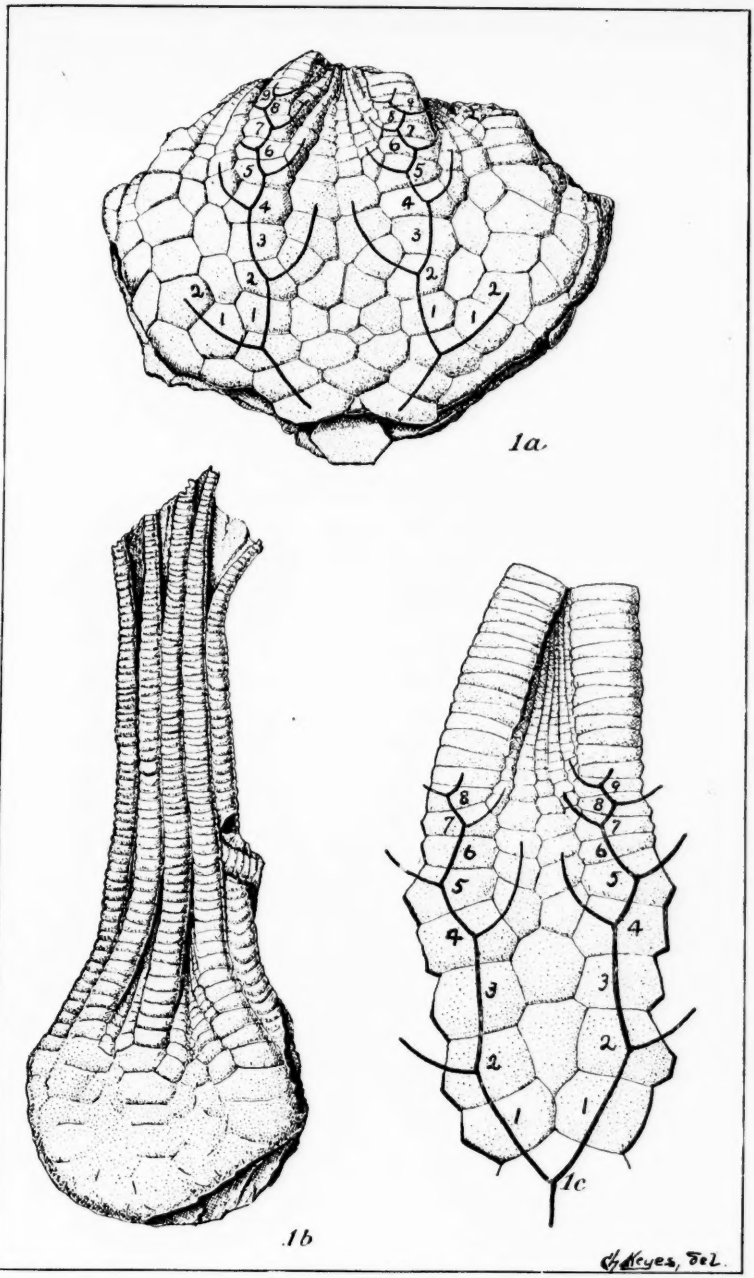
[3] Proc. Zool. Soc., London, 1895, pp. 974–1004, 1896.

available data, and has made the type of Uintacrinus the subject of a a special morphological study. In this treatment the previous work is briefly referred to; but some of it receives criticism that it does not appear to deserve, particularly since the foundation of most of the adverse comments lies not in any material error in the work referred to, but in what is manifestly a clear misinterpretation or hasty perusal of that work. It is to certain of these points in the structure of the form that attention is directed in the present note. In making the correction, however, it is not with the idea of reflecting on Mr. Bather's paper as a whole, for it is one of the most excellent contributions to echinoderm morphology that has yet appeared. The original figures in question from Bulletin 97 of the U. S. Geological Survey are herewith reproduced (Plate XV) in order to make more intelligible the exact points under consideration.

In the memoir mentioned considerable space is occupied in criticising a recent account of the species; but most, if not all of the objections urged against Doctor Clark's work, are certainly more imaginary than real. Professor Clark's figures come in for special condemnation as violating the fundamental law of the alternation of the pinnules. As a matter of fact his plate which is reproduced in the Proceedings as Plate LVI, to point out the alleged errors, not only shows that the accompanying statements are not true, but that in all three figures there is strict alternation of the pinnules in every case.

The general law in the pinnulation of the genus Mr. Bather states as follows: $IIBr_1$ none, $IIBr_2$ outer, $IIBr_3$ none, $IIBr_4$ inner, $IIBr_5$ outer, $IIBr_6$ none, $IIBr_7$ inner, $IIBr_8$ outer, $IIBr_9$ none. Two of his ten specimens differed from this general rule: one showing $IIBr_6$ inner, $IIBr_7$ none, $IIBr_8$ outer, $IIBr_9$ inner; and the other $IIBr_5$ none, $IIBr_6$ outer, IIB_7 inner, $IIBr_8$ none, $IIBr_9$ outer. He makes out the formula for the Clark figure 1a to be $IIBr_5$ outer, $IIBr_6$ none, $IIBr_7$ outer. The real formula for this is $IIBr_5$ outer, $IIBr_6$ inner, $IIBr_7$ outer, $IIBr_8$ inner, $IIBr_9$ outer. This appears clearly indicated in the figure, and Mr. Bather's statements that $IIBr_6$ has no pinnule is certainly a typographical error, for it cannot be that he mistook the rough, broken and highly raised edge of the brachial row of plates, with its deep shadow, for a suture line connecting with the first inside pinnule. The figure is of a somewhat crushed and distorted specimen, and the perspective is, perhaps, not as good as it might be. Whether or not it is the same as that figured by Meek (Bather's figure 2) is not known; but if the two are the same, the difference in the sketches are not very great nor radical, and certainly not as contradictory as Mr. Bather would have

PLATE XV.



Keyes on Uintacrinus.

us believe. The only real difference is that in Meek's figure there is above $IIBr_5$ a non-pinnulated brachial separating two pinnule-bearing arm-plates. The same extra plate is shown in figure 1c. The intercalation of a non-pinnulated plate of this kind is of common occurrence among crinoids, and should not excite any wonderment, let alone adverse criticism. In Uintacrinus this is of frequent occurrence, not only in different specimens but also in the different arms of the same individual. Mr. Bather himself shows that two out of the ten examples which he examined do not agree with his general formula. If his observations could have been extended it might have been found that one in three is just about the proportion of the individuals that do not agree in this respect. It might be added parenthetically that of 200 specimens of Uintacrinus that have been personally examined, fully one-half of them appear to vary in a similar way in the mode of pinnulation.

Granting then that Meek's original figure is correct in every detail and that figure 1a of Professor Clark's plate represents the same specimen, the differences are practically immaterial. Professor Clark's work not only does not violate the fundamental law of pinnulation but is essentially correct so far as typifying the species. The very object of adding an enlarged view of another specimen (figure 1c) was to make more clear the arrangement of the pinnules, since the convexity of the principal specimen and its distortion somewhat misrepresented these points. The same may be said of $IIBr_9$ in figure 1c. Usually from $IIBr_7$ on, the pinnules are turned in or are covered by the matrix if the specimen is not carefully cleaned, and consequently do not show from above. That $IIBr_9$ should be visible on one arm and not on another is not strange, and not necessarily incorrect.

Regarding Mr. B. H. Hill's diagram the formula given by Mr. Bather is probably correct for the figure; but, as he has stated, it is difficult to decide the question owing to the "rather peculiar mode of representation." It seems hardly possible that this diagram correctly represents the pinnulation of the specimen from which it was taken, and the entire disagreement of the corresponding plate faces when separated would further indicate that the figure is, as stated by Mr. Bather, "hopelessly incorrect," or illustrates a new species.—C. R. Keyes.

Geological News.—Paleozoic.—From data recently compiled, Prof. C. R. Keyes estimates the total maximum thickness of the Paleozoic rocks in the middle part of the central Mississippi basin, that is, in the neighborhood of the Missouri River, between Kansas City and the Iowa

boundary, to be 3000 feet. This differs considerably from the earlier estimates. (Amer. Geol., 1896.)

Bulletins No. 6 and No. 7, (1895) and No. 8, (1896) of the Illinois State Museum of Natural History contain descriptions of new Paleozoic Echinodermata, by S. A. Miller and Wm. F. E. Gurley. One new family (Thalamocrinidæ) and five new genera (Sampsonocrinus, Emperocrinus, Shumardocrinus, Thalamocrinus, Indianocrinus) are defined. In all, 156 species are described and figured.

MESOZOIC.—According to F. H. Knowlton, the fossil flora of Yellowstone Park represents three distinct stages. The first, or older flora, from the acid rocks embraces 79 forms; the second, or intermediate flora, has 30 species; and the third, or younger flora, comprises 70 forms. The author refers the first stage division to the Ft. Union or lower Eocene; the second is regarded as Miocene, but older than the Auriferous Gravels; and the third is probably of the same age as the Auriferous Gravels of California, that is, Upper Miocene. (Amer. Journ. Sci., July, 1896.)

A new fossil plant, *Salvinia elliptica*, is described and figured by Prof. Hollick. The new species is from the Upper Cretaceous of Washington State. (Bull. Torrey Botan. Club, Vol. 21, 1894.)

BOTANY.[1]

Botany at Buffalo.—In August (21 to 28) there were three botanical meetings held in Buffalo, as follows:

The Botanical Society of America met on Friday and Saturday in the High School, with eleven members in attendance. C. H. Peck, of Albany, and B. T. Galloway, of Washington, were elected to membership. The question of the desirability of a winter meeting was discussed and referred to the Executive Committee. Appropriate resolutions regarding the death of M. S. Bebb, a member, were adopted. The address of the retiring President, William Trelease, on "Botanical Opportunity," was given in open session on Friday evening. This will be printed in full in *Science* and the *Botanical Gazette*, and will also be distributed in pamphlet form by the Secretary. The following papers were accepted for presentation:

The Philosophy of Species-making. By L. H. Bailey.

[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

Some Characteristics of a Fresh-water Insular Flora. By Conway MacMillan.

Some Problems in Sporophyll Transformation among Dimorphic Ferns. By G. F. Atkinson.

A Species of Eleocharis New to North America. By N. L. Britton.

In the election of officers for the ensuing year, the following were chosen: John M. Coulter, Chicago, President; Charles S. Sargent, Brookline, Vice-President; Arthur Hollick, Brooklyn, Treasurer; Charles R. Barnes, Madison, Secretary; Benjamin L. Robinson, Cambridge, and Frederick V. Coville, Washington, Councillors.

The Botanical Section (G) *of the American Association for the Advancement of Science.* An unusually large number of papers were read before the Section, and it is not too much to say that in point of importance they fully maintained the high average of recent years:

1. The Relation of the Growth of Leaves to the CO_2 of the Air. By D. T. MacDougal.

2. Directive Forces Operative in Leaf Rosettes. By R. N. Day.

3. On *Crataegus coccinea* and its segregates. By N. L. Britton.

4. The Distribution of the species of *Gymnosporangium* in the South. By L. M. Underwood and F. S. Earle.

5. Morphology of the *Canna* Flower. By L. H. Bailey.

6. A Comparison of the Flora of Erie Co., Ohio, with that of Erie Co., New York. By E. L. Moseley.

7. The Significance of Simple and Compound Ovaries. By C. E. Bessey.

8. On the Bacterial Flora of Cheddar Cheese. By H. L. Russell.

9. The Terminology of Reproduction and Reproductive Organs. By C. R. Barnes.

10. A Comparative Study of the Development of some Anthracnoses in Artificial Cultures. By Bertha Stoneman.

11. The Development of Vascular Elements in the Primary Root of Indian Corn. By W. W. Rowlee.

12. Some Remarks on Chalazogamy. By J. M. Coulter.

13. The Habits of the Rarer Ferns of Alabama. By L. M. Underwood.

14. On the Stem Anatomy of Certain *Onagraceae*. By Francis Ramaley.

15. The Point of Divergence of Monocotyledons and Dicotyledons. By C. E. Bessey.

16. Notes on the Pine Inhabiting Species of *Peridermium*. By L. M. Underwood and F. S. Earle.

17. Reaction of Leaves to Continual Rain-Fall. By D. T. MacDougal.

18. Studies in Nuclear Phenomena, and the Development of the Ascospores in Certain *Pyrenomycetes*. By Mary A. Nichols.

19. The Stigma and Pollen of *Arisaema*. By W. W. Rowlee.

20. Notes on the Genus *Amelanchier*. By N. L. Britton.

21. Remarks on the Northern Species of *Vitis*. By L. H. Bailey.

22. On the Formation and Distribution of Abnormal Resin Ducts in Conifers. By Alex. P. Anderson.

23. The Development of the Cystocarp of *Griffithsia bornetiana*. By Arma A. Smith.

24. Notes on the Allies of the Sessile *Trillium*. By. L. M. Underwood.

25. On an Apparently Undescribed *Cassia* from Mississippi. By C. L. Pollard.

26. A Bacterial Disease of the Squash-Bug (*Anasa tristis*). By B. M. Duggar.

27. What is the Bark? By C. R. Barnes.

28. Embryo-Sac Structures. By J. M. Coulter.

29. Some *Cyperaceæ* New to North America, with Remarks on Other Species. By N. L. Britton.

30. Grasses of Iowa. By L. H. Pammel.

31. Ceres-Pulver: Jensen's New Fungicide for the Treatment of Smut. By W. A. Kellerman.

32. On the Cardamines of the *C. hirsuta* group. By N. L. Britton.

33. The Relation Between the Genera *Polygonella* and *Thysanella*, as Shown by a Hitherto Unobserved Character. By John K. Small.

34. An Apparently Undescribed Species of *Prunus* from Connecticut. By John K. Small.

35. The Flora of the Summits of King's Mountain and Crowder's Mountain, North Carolina. By John K. Small.

36. Parthenogenesis in *Thalictrum fendleri*. By David F. Day.

37. Notes on the Order *Pezizineae* of Schröter. By Elias J. Durand.

38. What Should Constitute a Type Specimen? By S. M. Tracy.

39. Rheotropism and the Relation of Repose to Stimulus. By F. C. Newcombe.

40. Some Adaptation of Shore Plants to Respiration. By Herman von Schrenk.

41. The Mechanism of Curvature in Tendrils. By D. T. MacDougal.

42. A Contribution to Our Knowledge of Turgor. By E. B. Copeland.

The Botanical Club. This vigorous organization fully justified its existence again. About forty papers were read. Many of these, of course, were notes, but others were of considerable value. Among the more important of these were the following:

The Distribution of *Phoradendron flavescens, Polypodium polypodoides* and *Bignonia crucigera* in Ohio. By W. A. Kellerman.

A Method of Distributing Fungi in Pure Cultures. By L. R. Jones.

Notes on Some Mosses. By Mrs. E. G. Britton.

Notes on *Iris*. By David F. Day.

An Improved Paraffin Bath. By F. C. Newcombe.

Notes on Oaks. By W. W. Rowlee.

Some Notes on Potato-Leaf Fungi. By L. R. Jones.

A Method of Preventing Condensation of Water in Culture Dishes. By H. L. Russell.

Notes on the Flora of Colorado Springs, Colorado. By Charles E. Bessey.

On a Species of *Epipactis*. By Elias J. Durand.

A Report Upon the National Herbarium. By C. L. Pollard.

Schizaea pusilla from Newfoundland. By Mrs. E. G. Britton.

Photosyntax *vs* Photosynthesis. By C. R. Barnes.

The Distribution of *Pinus ponderosa* in Nebraska. By Charles E. Bessey.

Some Curious Sunflowers. By J. F. Cowell.

Notes on Species of *Mnium*. By Mrs. E. G. Britton.

The Canyon Flora of the Plains. By Charles E. Bessey.

The Turgor of Mosses. By E. B. Copeland.

A Simple Apparatus for Spraying and Infecting Plants. By A. P. Anderson.

The Structure of Pseudoparenchyma in Higher Fungi. By Elias J. Durand.

Note on the Hosts of *Comandra umbellata* and *C. pallida*. By Herman von Schrenk.

The Submerged Leaves of *Salvinia natans*. By Conway MacMillan.

Nuclear Budding in *Cypripedium*. By Conway MacMillan.

An Unusual Adaptation of Conifers for Wind Protection. By Conway MacMillan.

Some Plants New to the Rochester Flora. By Florence Beckwith.

The Committee on Nomenclature made a report recommending that:

(1) A list of North American Pteridophyta and Spermatophyta be prepared for publication.

(2) A supplement be prepared to the present List of Pteridophyta and Spermatophyta of the Northeastern United States.

(3) The Rochester-Madison Rules be republished with annotations and explanations.

The officers for the next year are: President, S. M. Tracy, Agricultural College, Miss.; Vice-President, L. R. Jones, Burlington, Vt.; Secretary-Treasurer, E. Burgess, New York.

A New Manual of Systematic Botany.[2]—It is many years since American botanists have had the pleasure of examining a new manual of systematic botany designed for use in the northeastern States. We have had new editions of old books, but, unfortunately for scientific progress, through a remarkable misconception of the duties of executors, these editions were new mainly in type and binding, the additions and modifications having been purposely reduced to a minimum. It has been a matter of profound regret on the part of many of the friends and admirers of Dr. Gray that his books should receive such a treatment as to prematurely relegate them to the list of antiquated and obsolescent works. A new manual is, therefore, of peculiar interest at the present time, and this interest is enhanced by the fact that it comes from the scientific home of the older botanist, Torrey.

The volume before us is the first of the three volumes which will include descriptions and figures of all the ferns and flowering plants of the northeastern States and Canada. It is in every way a new work—new in its plan, new in its descriptions, new in its illustrations. Volume I opens with an eight-page introduction which is historical and explanatory. Here we learn that more than 4,000 species will be included, and that nearly three-fourths of these will be figured for the first time. Discussions follow on the principles of classification of plants, and the systematic arrangement adopted in the work (Engler and Prantl's). The following quotations are useful and suggestive: "The Nineteenth Century closes with the almost unanimous scientific judgment that the order of nature is an order of evolution and development from the more

[2] *An Illustrated Flora of the Northern United States, Canada and the British Possessions* from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean Westward to the 102d Meridian. By Nathaniel Lord Britton, Ph.D., Emeritus Professor of Botany in Columbia University, and Director-in-Chief of the New York Botanical Garden, and Hon. Addison Brown, President of the Torrey Botanical Club. Vol. I, Ophioglossaceae to Aizoaceae. New York: Charles Scribner's Sons. 612 pages, octavo, $3.00.

simple to the more complex." * * "Systematic arrangement should logically follow the natural order." * * "The sequence of families adopted fifty or seventy-five years ago has become incongruous with our present knowledge, and it has, for some time past, been gradually superseded by truer scientific arrangements in the later works of European authors." "The more simple forms are, in general, distinguished from the more complex, (1) by fewer organs or parts; (2) by the less perfect adaptation of the organs to the purposes they subserve; (3) by the relative degree of development of the more important organs; (4) by the lesser degree of differentiation of the plant body or of its organs; (5) by considerations of antiquity, as indicated by the geological record; (6) by a consideration of the phenomena of embryogeny. Thus, the Pteridophyta, which do not produce seeds and which appeared on the earth in Silurian time, are simpler than the Spermatophyta; the Gymnospermae in which the ovules are borne on the face of a scale, and which are known from the Devonian period onward, are simpler than the Angiospermae, whose ovules are borne in a closed cavity, and which are unknown before the Jurassic."

"In the Angiospermae the simpler types are those whose floral structure is nearest the structure of the branch or stem from which the flower has been metamorphosed, that is to say, in which the parts of the flower (modified leaves) are more nearly separate or distinct from each other, the leaves of any stem or branch being normally separated, while those are the most complex whose floral parts are most united."

"The sequence of families adopted by Engler and Prantl, in 'Natürlische Pflanzenfamilien' above referred to, has been closely followed in this book, in the belief that their system is the most complete and philosophical yet presented. The sequence of genera adopted by them has, for the most part, also been accepted, though this sequence within the family does not attempt to indicate greater or less complexity of organization."

The nomenclature is that of the well-known Rochester-Madison Rules of the Botanical Club of the American Association for the Advancement of Science, and, in order that the student may fully understand the matter, the rules are printed in full, with explanatory notes. As this work will at once become the standard botanical manual everywhere in this region for which it is designed, the revised nomenclature will soon be more familiar than the old which it is rapidly superseding.

The work proper opens with the family *Ophioglossaceae*, the lowest of the Pteridophyta, in which one species of *Ophioglossum*, and six of *Botrychium* are described and figured. Then follow *Osmundaceae* (3

species), *Hymenophyllaceae* (1 sp.), *Schizaeaceae* (2 sp.), *Polypodiaceae* (59 sp.), *Marsileaceae* (2 sp.), *Salviniaceae* (2 sp.), *Equisetaceae* (11 sp.), *Lycopodiaceae* (11 sp.), *Selaginellaceae* (3 sp.), and *Isoetaceae* (8 sp.).

The flowering plants, as we have been calling them, are here more correctly called seed-bearing plants (*Spermatophyta*), and are properly divided into two classes—*Gymnospermae* and *Angiospermae*, and the latter into the sub-classes *Monocotyledones* and *Dicotyledones*. As one turns over the pages, reading the full descriptions and comparing them with the excellent illustrations (which are always by the side of the descriptions) the conviction deepens that this book is one of the most important systematic works yet produced in this country. This is well illustrated in the treatment of the sedge and grass families which fill two hundred and sixty-six pages. Any one who has tried to puzzle out the genera and species of grasses and sedges will not have to be told of the great advantage which good figures will give to the student of these difficult families. It is not too much to say that no publication hitherto made has done so much to popularize the study of these plants as the one now before us. Of *Carex* alone two hundred and five species are figured!

We have not the space at our command to speak of the many changes in generic and specific limits with which this work will familiarize us. Nearly all of these have been known to specialists and those who have kept their eyes on the work of the German systematists, but to many the changes will come as novelties.

Among the minor matters may be mentioned the abandonment of the absurdity of calling families "orders," thus conforming to the usage in other departments of biological science. All family names (with a very few exceptions) are now made to end in *aceae*, a commendable practice which Dr. Gray used to insist upon. Throughout the work all diphthongs are printed in separate letters (*ae*, *oe*), and not in single characters (*æ*, *œ*), thus again conforming to the German usage. In the rules for pronunciation, a little easement is made for the use of the Roman pronunciation of botanical names, which we wish had been made a little more evident. We regret to see the use of feet, inches and lines still adhered to in this otherwise modern work. The metric units are so generally used in scientific books everywhere that we are surprised at this unexpected anachronism.

As we carefully study the beautifully-printed pages of this work, we are more and more impressed with its magnitude and importance. It will give renewed life and vigor to systematic botany, and doubtless will be the means by which many a student will be led to the study of

the more difficult families. It is so valuable in so many ways that we wish it would be made available to a greater number of students. We venture to suggest to authors and publishers that they bring out an edition *without the illustrations*, and printed on thin paper, with narrow margins. A single volume, portable edition of this admirable book, would greatly extend its usefulness.—CHARLES E. BESSEY.

ZOOLOGY.

The Heart of Some Lungless Salamanders.[1]—The recent literature of zoology has, perhaps, contained nothing more unexpected and startling than that certain adult salamanders are entirely lacking in those respiratory organs which, heretofore, have been deemed indispensable to the existence of animals so high in the zoological scale as the Amphibia. This total lack of lungs and branchiæ appears the more marvelous when we remember that they are absent in forms which lead a rather active and wholly terrestrial life, as well as in those of more or less purely aquatic habits.

Two questions are naturally suggested by this apparently aberrant condition of the respiratory organs. First, what structures or organs have taken on the functions of the lungs and branchiæ? and secondly, is there any modification in the form or structure of the heart which in any way may be correlated with the above mentioned peculiarities of these lungless forms?

The first of these two questions has been discussed to some extent by Prof. Harris H. Wilder, of Smith College, who first published an account of this apparently anomalous condition. He concluded that respiration was probably carried on by the skin and, perhaps, to some extent, by the mucosa of the intestine. Prof. Camerano has also published the results of some experiments upon two European forms which bear upon this same question. He believes that in these lungless forms respiration is effected in the bucco-pharyngeal cavity, and that the skin affords no efficient aid in the respiratory processes.

In a still later paper he discusses the subject further, and tries to account for the disappearance of the lungs. Of one aquatic species (of the genus Molge) he says: "The function of the lungs as hydrostatic organs, is very marked." "In the clearly terrestrial forms one would say that the diminution in importance of the function of the lungs as hydrostatic organs induces a retrogressive development of them while

[1] Read before the Amer. Assoc. Adv. Science, Aug. 24, 1896.

at the same time the importance of the bucco-pharyngeal respiration is increased."

It appears to the writer that Camerano's conclusions need to be tested by further experiments, especially the part referring to the respiration, for the area of the dermal surface far exceeds that of the bucco-pharyngeal cavity, and the skin is also very richly supplied with blood vessels which are so close to the surface that it would appear as if the gases of the blood and air might be readily interchanged. It is hoped that time will permit of some experiments on this point during the coming year.

As to the second question, whether there is any appreciable modification of the heart in these lungless salamanders, nothing whatever has been published.

It is the object of this paper to call attention to the fact that there is a difference in the heart of those salamanders that do not have lungs and those which do have them. So far as I have examined, it is possible to distinguish between the two forms by examining the heart alone.

In order that what is said on this point may be clearly understood by every one, and in order to bring out the differences between the two more sharply, if possible, I wish first to recall to mind the structure of the Amphibian heart and then contrast with it the relations as found in the heart of a lungless individual. We may take Huxley's description of the Amphibian heart as our standard of comparison. In his Anatomy of Vertebrates he says: "The heart presents two auricles, a single ventricle and a bulbus arteriosus. A venous sinus, the walls of which are rhythmically contractile, receives the venous blood from the body and opens into the right auricle. The left auricle is much smaller than the right and a single pulmonary vein opens into it." In regard to the septum of the auricles, he says that "it is less complete in Proteus, Siren and Menobranchus (Necturus) than in other Amphibia. In Menobranchus the septum is reduced to little more than a wide meshed network of branched muscular bands, and in Proteus the existence of a septum is doubtful."

The heart of our common Newt (Diemyctylus viridescens) Fig. 1 or of the large yellow-spotted salamander (Amblystoma punctatum), for examples, corresponds perfectly with Huxley's description. In both of these forms the auricular septum is perfectly complete, the cavities of the auricles being entirely separated, except just at the auriculo-ventricular aperature, at which point the two auricles communicate with each other to some extent.

In Necturus, the septum is more or less fenestrated and, according to Huxley, it is very incomplete in Proteus and Siren, but in all of the

PLATE XVI.

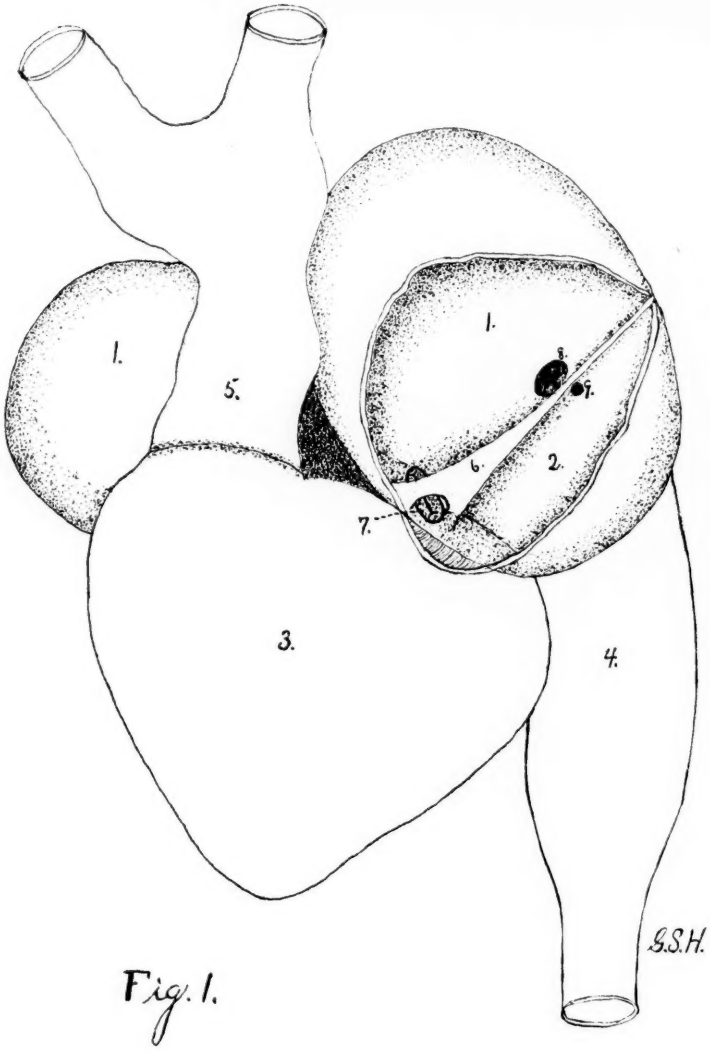


Fig. 1.

Hopkins on Diemyctylus.

PLATE XVII.

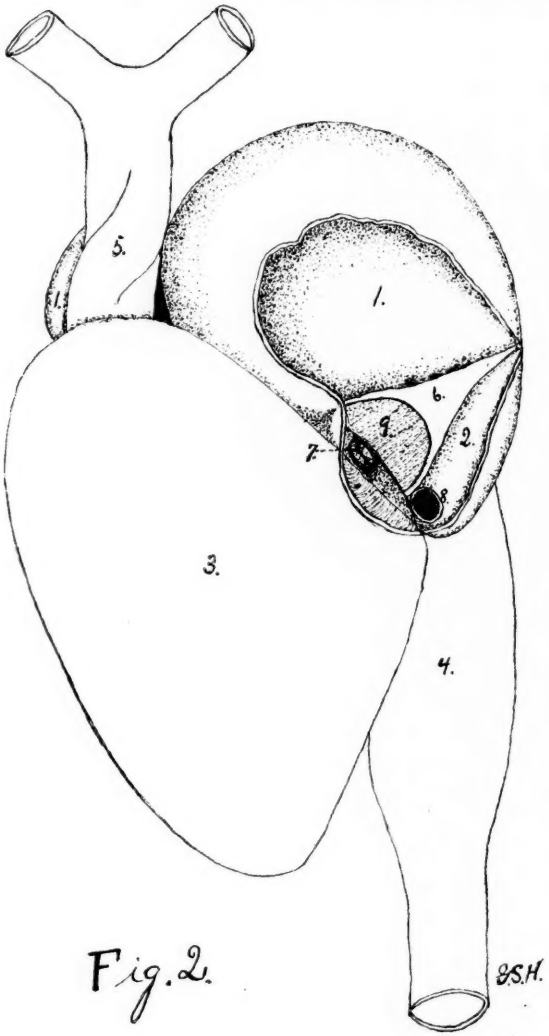


Fig. 2. S.H.

Hopkins on Desmognathus.

forms that have been mentioned, as well as in other members of the class Batrachia, the sinus venosus opens distinctly into the right auricle and the pulmonary vein into the left.

Let us now compare the heart of a lungless salamander (Fig. 2.) with the one just described. The four parts, auricles, ventricle, bulbus arteriosus and sinus venosus are clearly recognizable and, superficially examined, present nothing unusual; it is only when the cavities are opened that the differences between the two hearts become apparent. One of the first things to attract attention is the left auricle. In the lungless forms examined, it is much smaller in comparison to the right than in Diemyctylus, for example, and *no pulmonary vein was found opening into it.*

The auricular septum has only one opening through it, or perhaps, more correctly, it extends only part way across the cavity, but this aperture in the septum is so large (Fig. 2, 9.) that it is believed the communication between the two cavities is more free than even in Necturus. Just what function or functions the septum may have in these lungless forms, it seems to me, is not quite clear. That it has but little, if any use, is indicated by the way the sinus venosus opens into the auricles. In place of opening into the right auricle only, as in the forms having lungs, *it opens more freely into the left auricle than into the right.* If the ventral parietes of the heart be removed, one can look directly into the opening of the sinus venosus from either of the auricles, but more directly into it from the left than from the right, for when seen from the latter, one must look through the large opening of the auricular septum, Fig. 2, 9. In salamanders with lungs, each auricle opens in common into the ventricle with about equal freedom of communication, whereas in the lungless forms the right auricle is in more direct communication with the ventricle than is the left.

Judging from the above facts, i. e., the way the sinus venosus opens into the auricles, the freedom with which the auricles communicate with each other, and the way the auricles communicate with the ventricle, it would seem as if the heart of the lungless salamanders, functionally, was only bilocular in place of being trilocular as in the rest of the Amphibia. Morphologically, of course, it is trilocular, but whether it is so physiologically seems to me doubtful.

The heart of 8 lungless species have been examined by the writer, and so far as was made out, all of them agree closely with the description as given above. The probabilities are that in all the lungless forms similar conditions of the heart will be found. Up to the present time 17 species and sub-species, either wholly without lungs or with only

functionless rudiments of them, have been reported. In his last paper, in which are enumerated 15 of the 17 lungless species, Wilder says that "in the Salamandridæ lungless species are as numerous as those possessing lungs, and that in consequence of this, the definition of the group must be modified." It seems, however, that even with his proposed additions, the definition is still not sufficiently comprehensive, for the peculiarities in the structure of the heart certainly have almost as profound a significance as the absence of the lungs themselves, and should be incorporated in any definition that may be given. In addition to the 17 lungless species already mentioned, the writer has found an additional one, *Spelerpes gluttolineatus*.

In order that one may see at a glance in which families and genera lungless individuals are found, the following table, taken from Prof. Cope's Batrachia of North America, is appended. [The last column is taken from the papers of Wilder and others].

Families.	Genera.	No. of species.	No. species without lungs or with only rudiments of them.
Cryptobranchidae	Cryptobranchus	2	
	Megalobatrachus	1	
Amblystomidae	Amblystoma	12 [N. A.]	1 A. opacum
		1 [Siam]	
	Chondrotus	7	
	Linguaelapsus	2	
	Dicamptodon	1	
Hynobiidae [all Asiatic]	Hynobius	5	
	Salamandrella	2	
	Onychodactylus	1	
	Ranidens	3	
	Batrachyperus	1	
Plethodontidae	Plethodon	8	2 P. cinerus, P. erythronotus, P. glutinosus
	Hemidactylium	1	
	Batrachoseps	4	1 B. attenuatus
	Stereochilus	1	
	Autodax	3	1 A. lugubris
	Geotriton	? [European]	1 G. fuscus
	Gyrinophilus	1	1 G. porphyriticus
	Manculus	2	1 M. quadridigitatus
	Spelerpes	9	3 S. bilineatus, S. ruber, S. gluttolineatus
	Oedipina		
	Oedipus	9	
Thoriidae	Thorius	1	1 O. variegatus
Desmognathidae	Desmognathus	3	1 D. fusca, D. f. brimleyorum, D. f. auriculatus

Families.	Genera.	No. of species.	No. species without lungs or with only rudiments of them.
Salamandridae [Old World]	Chioglossa	1	
	Salamandra	3	
	Hemisalamandra	1	
	Triturus	6	
	Pachytriton	1	
Pleurodelidae [All found in Old World; three species in N. A.]	Salamandrina	1	1 S. perspicillata
	Diemyctylus	10 [2 N. A. species]	
	Pleurodeles	1	
	Glossolega	3	
Amphiumidae	Amphiuma	1	
Coeciliidae	(numerous)	(numerous)	

In the last column of the above table, the figures indicate the number of species in which lungless individuals have been found. Where there is a discrepancy in the numerals and the number of species following them, it indicates either sub-species or species not mentioned in Cope's Batrachia of North America.

Description of Figures.

Fig. 1. Heart of Diemyctylus viridescens (semi-diagramatic) to show the general relations of the heart of a salamander with lungs. The ventral wall of the heart has been removed in order to show the auricular septum, the openings of the sinus venosus and the pulmonary vein, and also the relation of the auriculo-ventricular aperture to the right and left auricle.

1. Right auricle; 2. Left auricle; 3. Ventricle; 4. Sinus venosus; 5. Bulbus arteriosus; 6. Auricular septum; 7. Auriculo-ventricular aperture; 8. Aperture of sinus venosus; 9. Pulmonary vein.

Fig. 2. Heart of Desmognathus fusca (semi diagramatic) to show relations of the heart in a lungless salamander. The ventral wall of the heart has been removed.

1. Right auricle; 2. Left auricle; 3. Ventricle; 4. Sinus venosus; 5. Bulbus arteriosus; 6. Auricular septum; 7. Auriculo-ventricular aperture; 8. Aperture of sinus venosus; 9. Opening through auricular septum.

G. S. Hopkins, D. Sc., Cornell Univ.

On two new Species of Lizards from Southern California. —Anota calidiarum Cope.—A single lateral fringe of conic scales, extending on three-quarters the length between the axilla and groin;

no trace of inferior fringe. Enlarged lateral gular scales only traceable below the rictus oris. Occipital horns moderate, each with a short accessory horn at the external base; internal temporal horn half as long as the occipital, with a short accessory horn at the external base; external temporal horn very short, and the temporal anterior to it presenting a serrate edge only. Infralabials presenting a serrate edge only; parietal region bounded on each side by an angulated border which overhangs the temporal region.

Squamation of the head smaller than in other species; superior labials twelve, below the middle of the eye, instead of eight or nine in *A. platyrhina* the nearest allied species. Seven subequal scales in the transverse row between the canthal rows on the frontal angle; there are five unequal scales on the corresponding position in the *A. platyrhina*. Six longitudinal rows of supraocular scales, of which a group of five or six posterior to the middle are larger, but unequal. Supraorbital rows in contact, except at points, on the median line; last superciliary presenting a sharp angle; penultimate also presenting a prominent angle. Tomia of mouth only moderately serrate; a row of conic scales rising posteriorly on the side of the neck, and above its posterior end an inconspicuous rosette. A conspicuous rosette above the middle of the humerus.

This species is nearest to the *A. platyrhina* Gir. from which it differs in various respects. The general proportions of all the parts and the coloration are about as in that species, the difference chiefly appearing in the squamation and the horns. The scales of the head are much more subdivided, and the presence of accessory horns is unique in the genus. The simplicity of the lateral fringe is also characteristic, as is also the rudimental character of the rosette on the neck.

Anota calidiarum Cope.

Catal. No.	Ariz. No.	No. species	Locality.	Source.	Obs.
8444	434	1	Death Valley, Cal.	U. S. Agric. Dept.	Alcoholic.

I may add here that in my estimation the genus Anota Hallow. is valid. It includes the species *A. modesta* Gir., *A. goodei* Stjen., *A. platyrhina* Gir., *A. maccallii* Hallow., and the above described.

SCELOPORUS VANDENBURGIANUS Cope.—This is a small species with small scales and very dark colors. There is not much difference in

the sizes of the dorsal, lateral and ventral scales; forty-five rows may be counted between the occiput and a line connecting the groins, and twelve in a head length. Between the groin and axilla thirty-five scales may be counted to an axillary area of smaller and smooth scales. The dorsal and lateral scales are keeled and mucronate; those of the inferior surfaces smooth and mostly feebly notched. Caudal scales strongly keeled and mucronate and larger than dorsals. Two parietals on each side, the anterior the larger, and extending to the narrow marginal supraocular row, so that there is only one frontoparietal on each side. A third parietal external to the other two. The frontal is not longitudinally divided. There is one series of six large supraoculars, separated from the frontals and frontoparietals all round by a series of small scales. External to the large supraoculars is a series of four much smaller polygonal flat scales much as in *S. biseriatus*. Between these and the superciliaries one row of still smaller scales (with an extra scale or two); two scales on the canthus rostralis. Head scales all smooth; six large free auricular scales. A single vertical prehumeral fold enclosing a pocket of granular scales; temporal scales keeled. The extended hind leg reaches to the auricular meatus. Temporal pores sixteen; male with postanal plates.

Color of adult male dark green above, with faint traces of a paler stripe on each side of the back, and of a few darker spots on each side of the middle line. Inferior surface dark blue, with a pale line in the middle of the abdomen. Femur spotted with blue below; tibia and tail light greenish below.

Measurements.

	MM.
Total length,	127
Length to vent,	57
Length to line of axilla,	22
Length to line of interparietal plate,	13
Length of hind leg,	38
Length of hind foot,	18
Length of fore leg,	23
Length of fore foot,	10

Sceloporus vandenburgianus Cope.

Catal. No.	No. spec.	Locality.	Donor.	Obs.
21931	1	Summit of Coast Range, San Diego Co., Cal.	Dr. E. A. Mearns.	Alcoholic.

I have seen of this species only one specimen, which is an adult male. The colors of the female may be expected to be somewhat lighter. I have dedicated it to Mr. Jno. Van Denburgh, of San Francisco, an able writer on herpetological subjects.—E. D. COPE.

Modification of the Brain during Growth.[2]—1. One of the most marked changes of the embryo brain is the formation of the great bend near its middle, giving rise to the cephalic fexure. The cause of the bend is unknown. After it is formed, the early appearance of optic fibers and those of the postcommissure and supracommissure tends to produce a comparatively fixed portion at this bend as shown by measurements of parts of the brain in soft shelled turtle and the cat. The later developing parts produce secondary changes in the form of the brain tube as the embryo takes on the specific characters of the adult.

2. The pons bend of embryo mammals is a feature of the brain of many non-mammalian embryos which do not possess a pons, and in specimens examined is associated with and seems to be due to the early and enormous development of the Gasserian ganglion and its union with the brain by the fifth nerve. Later these parts are overshadowed by the growth of other parts and the pons bend becomes obscure.

3. In the cat the pons bend is exaggerated by the formation of a great fist shaped mass of cells at the surface on each side of the meson. This mass of cells is continuous with a conspicuous layer of cells which extends upon the surface to the union of the solid wall of the oblongata with the membranous roof or tela. This layer and cell mass seem to be proliferations such as His and Herrick have described as occurring at the union of a solid wall with a membrane. Later these cells are covered by pons fibers.

4. In the soft shelled turtle and the cat, early stages show clearly that the prosotela, the membrane included by the edges of the rima in the cerebrum, is a continuation of the membranous roof of the diencephal, such that if the brain were plastic the continuation of each side could be brought to occupy the dorsal surface of its cerebrum. A condition would thus occur which is comparable with the actual condition found by Wilder in Ceratodus. It may be of value in the further determination of homologies between the brain of fishes and mammals, as in fishes the membranous roof of cerebrum and diencephal is continuous.

[2] Abstract of paper read before the Amer. Asso. Adv. Sci., Aug. 24, 1896.

5. The dorsal (sensory) and ventral (motor) zones of His, demarcated by a sulcus extending from the myel through the brain to the optic recess, have not been verified in the forms examined (cat, turtle, amphibia, bird). The indications are rather that an original segmented condition is partially disguised by a secondary formation of sulci which extend in a cephalo-caudal direction. None of the five such sulci found in the oblongata could be said to separate the sensory from the motor region. The dorsal and ventral of them demarcate raphés. One of them occurs *in* the sensory, two *in* the motor, but there is no dividing sulcus between the two regions. The extreme point to which any of them could be traced was in the region of the albicans, none of them reaching the porta or the optic recess. A second group of sulci arising in the optic and preoptic recesses extend to the porta, two of them passing through the porta to form the boundary of the striatum.

SUSANNA PHELPS GAGE.

The Lion of India.—The report that *Uncia leo* is found at the present time in the environs of Guzerate and Kutch appears to be an error. It has probably never existed in the latter locality, and is now to be met with only in the forest of Gir in the Kathiawar. It has disappeared from Rajkot, where it was abundant in 1832, from the hills of Bardo, and from many other localities where it formerly existed in great numbers, nor has it been seen for a long time in the forest above mentioned. Formerly hunters very seldom ventured in that region for fear of the bandits who were in the habit of taking refuge there, and also for fear of contracting fever. Gradually, however, the forest is being cleared away, settlements are being made, and the domain of the lion is being curtailed. To prevent total extinction of the species, the Durbar of Kathiawar has forbidden lion hunts for a period of six years. But this will do no good unless at the same time a forest reservation is made.

The popular belief that this species is without a mane in India is another error that is corrected. (Revue Scientif. Août, 1896).

Inheritance of Artificial Mutilations.—The instance cited by Mr. Norman E. Hills (in the September Naturalist) of the birth of short-tailed fox terriors, is striking in showing a larger proportion of deformed puppies than is common in such cases, but instances like the one cited are frequently noted in the press devoted to dogs, and concerning several breeds that have been mutilated for generations.

But to thoroughly consider the matter of the inheritance of artificial deformities, the cases of breeds in which the deformity is usually

natural, should be considered. I believe the tailless Manx cats generally come in that shape, and this I know is often the case with the bobtail sheep-dog of England, and this is stated of several breeds of dogs, generally of the type of the bobtail sheep-dog found in other countries, Norway, Southern Russia and elsewhere.

But the peculiar feature of this inheritance is its freakishness. Two naturally long-tailed parents have produced a tailless dog, in whom the potency was so strong that no bitch, no matter what the breed was, ever produced a full, natural tailed puppy to him. I remember of one puppy by this dog, ex his double grandam (he was the son of litter brother and sister) whose tail was of usual length, but had a deformity in it as though it were tied in a knot. Again, it is not at all uncommon for a bitch to begin production with all naturally long-tailed puppies, and after some years, change to always producing some tailless ones, even when mated with mongrel dogs, while some bitches reverse the order, beginning with tailless ones and changing to full-tailed ones. I recently noted a reported instance of just such a change of production in a Manx cat, and it seems to me that this freakishness introduces a very disturbing element into consideration of the question of inheritance.

As an allied matter, please permit me to say that the notion that if a bitch has a mongrel litter she will thereafter *always* produce puppies showing traces of the unallied sire, is rank rubbish, and on the point that this occurrence is *not* invariable, any experienced breeder will concur, as very, very few such breeders have ever seen such a case. For myself, I have bred dogs for over forty years, have bred many mongrel litters, and never saw a case of telegony—or, as we commonly call it, "influence of previous sire." That this influence does sometimes show itself, is beyond doubt; but some very extended inquiries of mine some years since, showed that it was shown only in about one per cent. of cases of mesaliances; and when it was considered that an instance of this "influence" will be remembered from its extraordinary character, while instances where it does not occur are forgotten, being the expected result, I believe that the one-tenth of one per cent. of cases will be found to be the extent of its occurrence. It is very strange that those scientific men who uphold the idea of the invariable occurrence of this "influence," all overlook the potent fact that the "influence" shows itself invariably only in the skin and hair, never affecting conformation. In view of this, the theory propounded by Dr. Jonathan Hutchinson, President Royal College of Surgeons; Dr. J. Sidney Turner, President South British Medical Society, and Everett Millais, Esq., seems sound, and bears against the idea of the bitch being herself

bastardized, that theory being that unripe ova are partially impregnated by the spermatozoa of the foreign male, not sufficiently to fully vivify them, the influence of this impregnation affecting only the epiblast, from which the skin is evolved, and a subsequent fertilization brings full life to the ova, determining other features of the fœtus. Thus, in the case of a pug bitch, which had a mongrel litter by a Skye terrior, and at her subsequent whelping by a pug dog, had some puppies with rough hair, these "influenced" puppies had the conformation of the pug all over, even to the twisted tail.

However, be the scientific part of the question what it may, the too common idea that a bitch having a mongrel litter will show influence of that litter in all future offspring, is utterly fallacious.

Yours truly, W. WADE.

Oakmont, Pa., Sept. 14, 1896.

ENTOMOLOGY.[1]

A New Character in the Colobognatha, with Drawings of Siphonotus.—In all known Diplopoda the external seminal apertures are located just behind the second pair of legs or in the coxæ of the second legs. In all Diplopoda except Polyxenus one or more pairs of legs are more or less modified to assist in copulation. In a great majority of forms the legs most modified are those of the seventh segment, but in two groups, the Omniscomorpha and Limacomorpha of Pocock the legs of the seventh segment are unmodified, while one or more pairs at the caudal extremity of the body are transformed into copulatory organs. The modification which has taken place in the Limacomorpha is very slight, for according to Mr. Pocock's descriptions and figures the last legs of *Glomeridesmus marmoreus*[2] consist of four or five joints and differ from the others mostly in being shortened and thickened. An equal or greater degree of specialization is now known to exist in other legs than those of the seventh segment, indeed, an almost equal peculiarity of structure is sometimes manifested by nearly all the male legs of certain genera of Polydesmidæ, Spirostreptidæ and Spirobolidæ. Especially noteworthy are the first pair of legs in Iulidæ, Parajulidæ and Pæromopodidæ; the second pair of legs of Stemmatoiulidæ and Parajulidæ; the third pair in Striariidæ. With-

[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

[2] Journ. Linn. Soc. Zool., XXIV, 475.

out detailing the very numerous and striking contrivances displayed by nearly all the anterior legs of some Craspedosomatidæ, it is sufficient to point out that in Scytonotus[3] modifications apparently as great as those of Glomeridesmus occur as far back as the twentieth pair of legs. In the light of these facts the degree of modification shown by Glomeridesmus counts for little or nothing as an evidence of relationship with the Oniscomorpha. It might be said that Glomeridesmus has no copulatory legs at all, for the structures figured by Mr. Pocock are probably not comparable with the true copulatory legs of the other Diplopod groups, either in structure or function. The really remarkable thing about Glomeridesmus is that the legs of the seventh segment are not modified. Yet on this account we are not obliged to arrange Glomeridesmus in a separate category, for the degrees of modification to be found in the legs of the seventh segment of the other Diplopod groups are very various. It is even possible to trace, in the second pair of legs of the seventh segment of Craspedosomatidæ all the stages from the nearly normal to the completely modified condition. Thus with reference to the fact that the seventh legs are unmodified, Glomeridesmus may be looked upon as one end of a series, not necessarily farther removed from the other groups than they are from each other. Certainly the distance between the unmodified legs of Glomeridesmus and the distinctly jointed copulatory legs of Polydesmoidea and Polyzonoidea is not greater than that between those of the Polydesmoidea and the Spirostreptoidea.

If, however, we admit that differences in the position and degree of modification of legs transformed for copulatory purposes are not of themselves characters of fundamental importance in the Diplopoda, we may seem to be under the necessity of admitting in addition that the constant appearance of what we may call the true copulatory legs in the place of the anterior or both pairs of the seventh segment is an evidence that the Helminthomorpha of Pocock are a homogeneous group to the extent of having more affinity with each other than with the Oniscomorpha. If, however, facts exist which indicate that the copulatory legs may have had independent origins in any of the Helminthomorpha the evidence just referred to is largely overthrown, for the utter diversity in plan of the copulatory legs of the different orders of Diplopoda is itself a strong indication that they represent independent lines of development. Such seems to be the import of the fact that the legs which in the Merocheta[4] are primarily transformed

[3] Am. N. Y. Acad. Sci., VIII, 233 (1894).

[4] An ordinal name to cover the Polydesmoidea, Craspedosomatoidea and Callipodoidea. Cf. Ann. N. Y. Acad. Sci., Vol. IX, (1895).

into copulatory organs, the anterior pair of the seventh segment, are in the Colobognatha *entirely unmodified*. Hence we must suppose that either the legs or the function have migrated, in case we assume a common origin and attempt to homologize the copulatory legs in the two orders. The theory of migration, however, has no facts to support it, and would be equally fatal to the idea that affinity or the want of it can in the Diplopoda be inferred from the position of the copulatory legs.

The fact that the Colobognatha have eight precopulatory legs is not new, but up to this time the whole eight have been supposed to belong to the first six segments. Both Latzel and Pocock[5] give the distribution of these legs as in the second column. In reality the arrangement is that of the third column.

	Latzel.	*Siphonotus.*
First segment,	First pair,	First pair.
Second segment,	Second pair,	Second pair.
Third segment,	Footless,	Third pair.
Fourth segment,	Third pair, Fourth pair.	Fourth pair.
Fifth segment,	Fifth pair, Sixth pair.	Fifth pair.
Sixth segment,	Seventh pair, Eighth pair,	Sixth pair. Seventh pair.
Seventh segment,	First copulatory, Second copulatory,	Eighth pair. First copulatory.
Eighth segment,	Eleventh pair. Twelfth pair,	Second copulatory. Eleventh pair.

My attention was first attracted to these facts while engaged in examining specimens of Siphonotus collected in Sierra Leone in December, 1893. The creatures were abundant in decaying banana stumps in Freetow, and I secured a large quantity. Instead of curling up as nearly all the representatives the present order are accustomed to do when placed in alcohol, my specimens remained conveniently straight and pliable so that they could be mounted in alcohol or balsam and studied to advantage. Of the arrangement of the legs as here stated there can be no doubt. The drawings are mostly camera tracings made from preparations in balsam. In order to make sure of the condition in Polyzonium, the genus studied by Latzel, I cut animals in two horizontally, brushed away the internal structures and mounted in balsam.

[5] Mr. Pocock seems to have come to doubt this disposition, for he uses a "?" in front of his last statement on the subject.—Max Weber's Reise, p. 335.

Without such a preparation satisfactory observation is very difficult if not impossible in Polyzonium, for all the parts, especially the bases of the legs, are crowded together. I have examined in addition Andro, gnathus, Platydesmus, Pseudodesmus, Siphonorhinus and Siphonophora without finding any indications that the condition described is not present in all, though a final demonstration would in most cases not be easy without dissection.

Probably correlated with the comparatively slight degree of specialization which appears in the copulatory legs of the Colobognatha is the fact that in young males of Siphonotus the copulatory legs are several-jointed before maturity. Such a condition seems to be unknown in the other helminthomorphous groups.

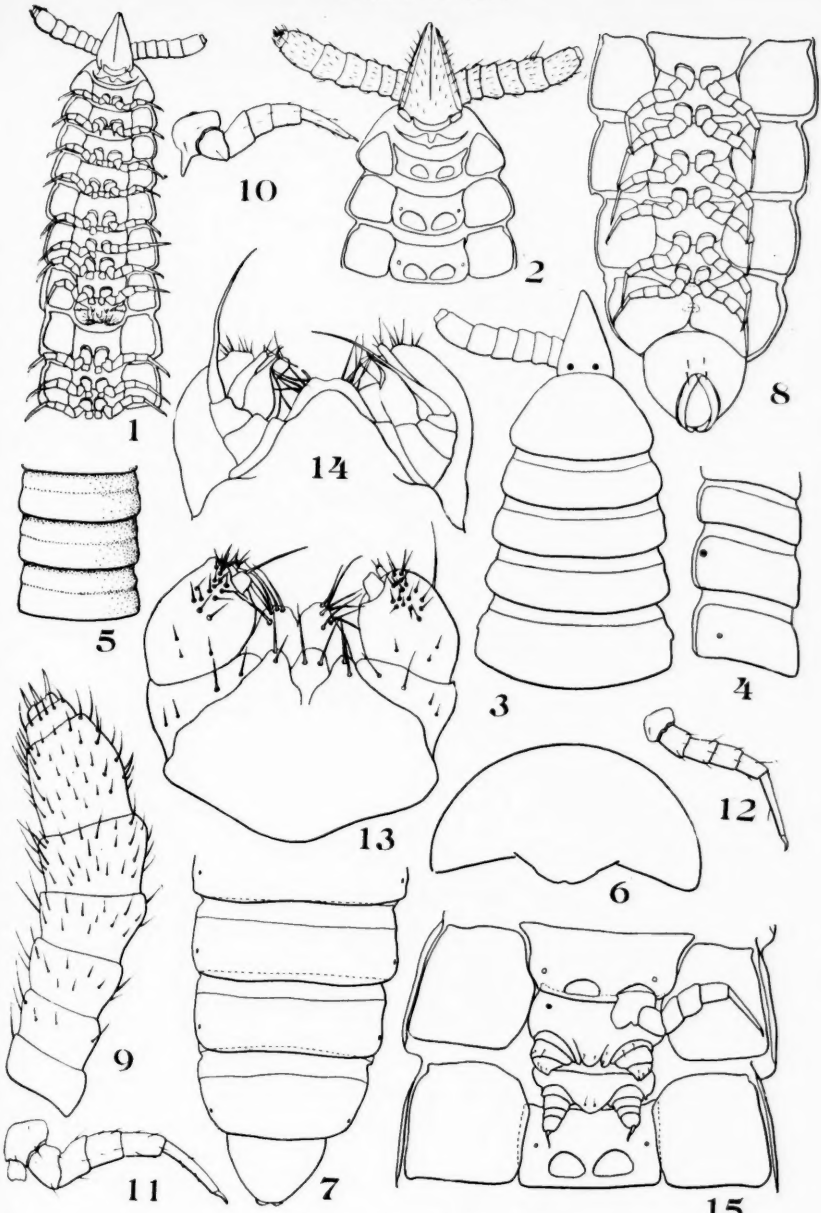
In the previous discussion there has been no intention to imply that the orders Oniscomorpha and Limacomorpha are not valid; the contention is merely that the position of the modified legs does not *of itself* justify holding them as divisions of greater weight than other natural groups of Diplopoda, some of which have been designated by ordinal names. It is to be expected that future study may result in a natural arrangement of the groups now designated as orders, but until their affinities are demonstrated nothing is to be gained by attempting to retain under one ordinal name and description animals which may prove to be widely divergent in their development history. Thus it is by no means impossible that the Colobognatha are really a group farther removed from the other Helminthomorpha than are some of these latter from the Oniscomorpha. Many of the peculiar characters of the Oniscomorpha are evidently the result of their power to roll themselves into a sphere, and are not to be assigned great weight in estimating affinities.

Systematic Note.—The genus Siphonotus has not until very recently been reported since its establishment by Brandt in 1836. Within the last year or two Mr. Pocock has described species from St. Vincent (West Indies), Java and Celebes. To me it seems doubtful whether any of these species are congeneric with Brandt's type *S. brasiliensis*. Provisionally, however, the species of which drawings are presented may be described under Siphonotus, no doubt being possible that its affinities are here rather than with any other genus yet established.

Siphonotus africanus sp. n.

Body slender, the sides parallel to near the ends, or very slightly converging cephalad.

PLATE XVIII.



Siphonotus africanus Cook.

Head smooth and shining, sparsely hirsute distad.

Eyes of a single ocellus on each side, large and strongly pigmented.

Antennæ sparsely hirsute, strongly crassate, scarcely clavate; joints increasing in length from the first to the sixth.

Hypostoma distinct, medianly deeply excavate.

Mentum distinct, on each side a large cardo (?). Other parts of gnathochilarium indistinct; the lines of the figures may represent internal structures only.

First segment longer than the others, which increase in length to the middle of the body and are scarcely shorter caudad; surface of all the segments smooth and shining.

Repugnatorial pores in a continuous series from the fifth segment, removed considerably from the margin of the scuta, except those of the fifth segment, which are also distinctly larger than the others.

Pleuræ large and entirely free, smooth and shining.

Pedigerous laminæ distinct, free; sometimes the edges of the pediger. ous laminæ and the pleuræ lie one upon the other.

Penultimate segment without legs, in contact or overlapping, but not closed below.

Anal valves narrow; preanal scale wanting.

Legs sparsely hirsute, all six-jointed, with a rudimentary second joint which would make seven.

Males with a conic process from the coxæ of the second legs. All the other legs except the first have a coxal aperture from which projects a transparent membrane or secretion.

Male genitalia, see figures.

Color of living animals, pinkish, pale to dull reddish-pink.

Length of mature individuals up to 15 mm., width .75 mm.; segments of adults 39–55. The males are distinctly smaller than the females. The young male specimen from which fig. 15 was drawn has 24 segments, all but two of which bear legs, as in the mature animals.—O. F. Cook.

Explanation of Plate.

Siphonotus africanus.

Fig. 1. Head and first nine segments, ventral view, to show arrangement of legs.

Fig. 2. Head and first three segments, ventral view, the legs removed to show pedigerous laminæ, spiracles, etc.

Fig. 3. Head and five segments, dorsal view.

Fig. 4. Segments 4–6, lateral view, to show the peculiarly enlarged pore of the fifth segment.

Fig. 5. Three normal segments, dorsal view, less magnified than fig. 3.
Fig. 6. Diagrammatic cross-section, showing relative positions of the parts of the exo-skeleton.
Fig. 7. Last five segments, dorsal view.
Fig. 8. Same, ventral view.
Fig. 9. Antenna, much magnified, ventral view.
Fig. 10. Second leg of male.
Fig. 11. Eleventh leg of male.
Fig. 12. Last leg of male.
Fig. 13. Male copulatory legs, dorsal view.
Fig. 14. Same, ventral view.
Fig. 15. Segments seven and eight of young male.—O. F. Cook.

PSYCHOLOGY.[1]

Congress of Psychologists.—The third Congress of Psychologists was held at Munich, August 4th to 9th, Prof. Stumpf, of Berlin, presiding. It was the largest and in many respects the most successful of the three. Of course the German attendance was fuller than at the last one, held in London in 1892, and German delegates are always most welcome. When we take into account the fact that Germany is to-day the country where psychology is most vigorously and successfully pursued, it follows that this Congress was, up to date, the greatest gathering of eminent psychologists ever seen. As to France, the attendance was disappointing in numbers, although the delegation was very representative; and the same is true of the British contingent. The other countries, except America, were adequately represented; the small attendance from our side of the water being a matter of the more surprise in view of the tendency of our professors to take their vacations abroad—indeed, the attendance at the last Congress in London was considerably larger.

In its general character, the tendency to allow the popular attendance upon the meetings to swamp the scientific proceedings was more marked in Munich, and it is not too much to say that this constituted a very great defect in the arrangements. The membership was over four hundred. There was a constant flow from hall to hall, and the corridors

[1] Edited by H. C. Warren, Princeton University, Princeton, N. J.

were filled with bewildered persons. Some limit must be put on the popular membership at the next congress, or the scientific people will yield the field to the sightseers and amateurs. The other possible improvement comes to the front again apropos of this meeting in Munich —the crowded condition of the programme. Besides the general meetings, which came in the forenoon sessions, the committee arranged for five sections, all running simultaneously and all subject to constant give and take, as respects their audiences, from one to another. Besides the constant interruptions and great confusion which this produced, it practically prevented a person from hearing many readers whom he especially desired to hear. Since the time limits were not enforced upon the papers or discussions, one could never tell how far on this section or that had progressed, and so could not time his presence for any particular reader. Moreover, the papers were as usual so generally accepted by the committee—anyone who wanted to present something had only to send his name and topic beforehand—that many were read which were of little or no scientific value; and the titles of papers were entered on the programme in advance, so that there was no way to learn infallibly whether a particular reader had arrived and would present his dissertation or not. The gaps left by the absentees were consequently quite an unknown quantity. Every such meeting should have a committee to read and select from available papers, arrange them strictly according to unchangeable time divisions, and require each reader to report finally a day or two before the meeting as to his actual attendance, the final programme being only then printed. This would have the further advantage of ruling out titles and names which are from the first doubtful; for it is astonishing to what an extent men fail to carry out what should be their serious intention when they give their names to be printed on these Congress programmes.

So much for the general character of the Congress. Of course, this is not the place for an account, in any detail, of its scientific features. The division into sections will show something of the remarkable range that modern psychology finds itself obliged to take: "Normal," "Sleep and Hypnotism," "Mental Pathology," "Neurology," "The Senses and Psychophysics"—the titles being somewhat abbreviated in this list. In each of the sections there were some great papers and one or more lively discussions. The most interesting thing in the way of neurological work—it was presented, however, in one of the general meetings—was the paper by the veteran Flechsig on "Association Centres." It will be remembered that Prof. Flechsig has been engaged for some time on comparative studies of the brains of human infants at different ages,

attempting so to arrive at a view of the order of development of the elementary mental functions, with the corresponding progress in brain anatomy and physiology. He has published very rich results from time to time, and among them is his determination of certain so-called "association centres." He thinks that the much discussed frontal region of the brain is the location of associations of a higher and more abstract kind; and that in the region back of the well-known "motor region," extending to the visual centre in the occipital region, is a great centre for the associations which bind the sense functions together. This in brief, and without the discriminations which an accurate account of his views should make. The reason which he gives for these determinations is that only after some growth, and after the senses are well developed, do we find the great masses of connecting fibres which traverse these regions forming in the child's brain.

Apart from the question of fact, as to which Prof. Flechsig's researches may be considered as being of the greatest importance (especially when we consider his method), it is difficult to see how these regions can be, in any true sense, "association centres;" for, admitting that the connections between the sense centres run through these regions, the main thing about the associations must be the things associated, not the mere fact of connections between them. One would hardly call the bunch of telegraph wires on the housetop a "communication centre;" the loci of communication are still at the telegraph offices. Without them, the wires would be possibly even more helpless than the offices without the wires. Prof. Flechsig's paper was a model for imitation in the manner of its presentation, and its interest was enhanced by slides showing the infant's brain, in sections illustrating the periods of its growth.

Another contribution to the understanding of the relation of psychology and brain physiology was that of the well known neurologist, Prof. Edinger, of Frankfort, on the question, "Can Psychology make use of the results so far attained in Brain Anatomy?" He did not confine himself to anatomy, but presented a series of interesting notices on the development of the nervous system in the scale of life, and made a strong plea for a corresponding genetic study of comparative psychology. Genetic psychology, he says, is so far behind analytic psychology because psychologists have confined their attention, on the anatomical side, to the cerebral hemispheres, while what they should do is to study the evolution of the nervous system all the way up, and see the progress of consciousness with it. "Gerade auf diesem Gebiete müssen anatomisch-physiologische und psychologische Studien durchaus Hand in Hand gehen." All this is true and remarkably opportune, I think,

despite the fact, that in his main illustration Prof. Edinger falls into one of the glaring fallacies into which this sort of analogy between body and mind may lead. He says there are certain creatures (fishes) which have no hemispheres, and it follows that, on the psychological side, we must deny to these creatures "all that the hemispheres are necessary for in the higher creatures." This overlooks the great principle that, in the lower forms, less differentiated structures may do what more differentiated ones do in the higher forms. To press this point consistently, he would seem to have to deny consciousness altogether to these fishes. The lesson of this paper, however, is a most timely one; psychologists, especially in Germany, are not half awake to the genetic problem, and when they do awake, no doubt it is true that the richest lessons that the physiology of the nervous system will have to teach them will be derived from such comparative study as Prof. Edinger advises.

Several papers of general interest were read in the open meetings. The President's address was rather more severe and *wissenschaftlich* than the earlier addresses of the presiding officers have been, but it was an exceedingly interesting and discriminating review of theories on the connection of mind and body. The arraignment of Parallelism was very effective—possibly more so than the positive doctrine of the paper. Prof. Ebbinghaus of Breslau gave a new way of testing the mental condition of school children at different periods and in different conditions of fatigue, etc. It differs from the methods already in vogue in that it endeavors to test the child's correlating or apperceptive faculty rather than his sense-perceptions or his memory. The method, which teachers will find extremely interesting, consists in taking a passage from some interesting narrative-text, and, after striking out various words and phrases and printing the passage with black spaces where these erasures have been made, telling the child to fill in the spaces as he thinks the sense requires. This requirement certainly calls upon the child for more than memory, and the results of its application, as reported by Prof. Ebbinghaus, seem to show its superiority; but it would appear to be applicable to children of a more advanced age, after the memory tests are outgrown. This general judgment, however, I must make with reservation, since the synopsis of the paper did not reach my hands. This may suffice to indicate the scope of the method, and to call the attention of our educational authorities to it. They will also be interested in Prof. Ebbinghaus's severe criticism of what he called the "American method" of testing the mental condition of school children by the memory tests.

The fact that the papers on "Hypnotism" were fewer than in earlier congresses, in proportion to the entire number, and that there were a bare half-dozen on thought-transference and telepathy, shows the general tendency of psychology. The hypnotic period is past, even in France. Not that the gain from the study of hypnotism has not been permanent and great; on the contrary, its results are only now getting so absorbed into the body of psychological truth that it no longer makes sensational appeals for a hearing. As to telepathy, I think there is a real decay of interest in the subject, much as this is to be deplored. The most interesting paper in the hypnotic field was a general one by Prof. Pierre Janet.

The section on the Senses and Psychophysics did much exact work. Dr. Stratton of the University of California communicated some valuable experiments of his own on the artificial reinverting of the retinal image and its effects on the sense of bodily position in space, which will be of especial interest to those who think the normal inversion of the image requires a theory.

Two other general questions of great interest were discussed, with as much ability as vehemence, by the Vice-President of the Congress, Prof. Lipps, of Munich. One of his papers was a very important contribution in the sadly neglected field of the æsthetics of visual form. I can do no more than recommend his paper in the Congress "Proceedings" (to appear very soon) to those who are concerned with elementary æsthetic principles. The other topic was the much-discussed one on the "Unconscious" in psychology. The question, Can mental states be unconscious? has a peculiar fascination, because of the great number of verbal distinctions of which it admits. It must be confessed that Prof. Lipps's paper did not make the number of these verbal distinctions less. He reaches a sort of return to the soul-substance theory—a hidden thing in which mental states, and especially tendencies of an active kind, may be preserved when we are not conscious of them. This has long ago been refuted as a general conception, I think; but the main point of interest, and that for which I bring the matter up, is that the results of pathology, dual consciousness, "multiple personality," etc., which are considered by many as giving the strongest evidence for the "unconscious," require quite a different theory. The "unconscious" of the pathologists is a body of conscious data gathered into a new and secondary consciousness of its own. While these states of mind are not conscious to the major person—and so, by a certain license, are called "unconscious"—still it is just the evidence that they are conscious in their own way and in their own seat in the nervous

system that enables us to say that they are mental. So all this evidence goes, after all, to show a correspondence between the mental and the conscious. This Prof. Lipps does not seem to see, and his treatment of the question from a purely verbal and analytic point of view was consequently very inadequate.

In the higher fields of ethics and anthropology there were interesting papers, of which my space allows the mention of only one on "Ethical Values," by Prof. Ehrenfels (just called from Vienna to Prague), and one on the "Category of Individuality in Savage Thought," by Mr. Stout, the editor of *Mind*. Mr. Stout, I may add, has just been called to a lectureship in comparative psychology in the University of Aberdeen—a novelty for the British Isles, but appropriate in the institution which Prof. Bain has made famous in connection with psychological study. The next Congress is to meet in Paris in 1900 in connection with the Universal Exposition. Prof. Ribot will be President; M. Ch. Richet, Vice-President, and M. Pierre Janet, Secretary. The International Committee for the Paris meeting has the following American representatives: Profs. James (Harvard), Titchener (Cornell), Hall (Clark), and Baldwin (Princeton).

I cannot close this letter without referring—with profound regret, which many other American students of philosophy must also feel—to the death Prof. Avenarius, of Zurich, on August 18. Where I now write, the feeling that one of the greatest philosophical thinkers of Europe no longer adorns a Swiss university is very acute; and those who know the work of Prof. Avenarius must feel it also, regardless of the place of their habitation.—J. MARK BALDWIN, in *New York Evening Post*, Sept. 12.

Mental Action During Sleep, or Sub-Conscious Reasoning.—Shortly after reading the interesting article by Professor Cope with regard to recent ethnological discoveries in Assyria, undertaken under the auspices of the University of Pennsylvania, and elucidated by Professor Hilprecht, I met with the account of a peculiarly curious dream which had been experienced by Professor Hilprecht whilst his mind was deeply occupied with these very investigations.

It is of course well known to all students of mental psychology, that the most complicated, abstruse forms of reasoning have often been carried out in dreams; and many interesting and well authenticated cases of this phenomenon will be found in Dr. Carpenter's Mental Physiology.[2] But the peculiarity of Dr. Hilprecht's dream consists in

[2] Chap. XIII, Unconscious Cerebration. Mental Physiology. W. R. Carpenter, M. D. Chap. XV, Of Sleep, Dreaming and Somnambulism, pp. 534, 593-5.

the intensely dramatic manner in which the solution of the problem he was engaged on was conveyed to his mind. I will now simply quote from the account given to Prof. William Romaine Newbold, by Professor Hilprecht, in the first place of a train of sub-conscious reasoning during sleep which put him on the track of a satisfactory rendering of an Assyrian proper name; and in the second place of the work carried out under the influence of a strangely dramatic dream.[3]

"During the winter 1882–3, Professor Hilprecht was working with Professor Friedrich Delitzsch, and was preparing to publish as his dissertation, a text, transliteration and translation of a stone of Nebuchadnezzar I, with notes. He accepted at that time the explanation given by Professor Delitzsch of the name Nebuchadnezzar, 'Nabû-kudurru-usur,' 'Nebo protect my mason's pad' or mortar board,' *i. e.*, 'my work as a builder.' One night, after working late, he went to bed about two o'clock in the morning. After a somewhat restless sleep, he awoke with his mind full of the thought that the name should be translated 'Nebo protect my boundary.' He had a dim consciousness of having been working at his table in a dream, but could never recall the details of the process by which he arrived at this conclusion. Reflecting upon it when awake, however, he at once saw that *kudurru*, 'boundary,' could be derived from the verb *kadaru*, to enclose. Shortly afterwards he published this translation in his dissertation, and it has since been universally adopted."

Mr. Newbold then gives a translation from the account written in German by Prof. Hilprecht of his remarkable dream.

"One Saturday evening, about the middle of March, 1893, I had been wearying myself, as I had done so often in the weeks preceding, in the vain attempt to decipher two small fragments of agate which were supposed to belong to the finger rings of some Babylonian. The labor was much increased by the fact that the fragments presented remnants only of characters and lines, that dozens of similar small fragments had been found in the temple of Bel, at Nippur, with which nothing could be done, that in this case furthermore I had never had the originals before me, but only a hasty sketch made by one of the members of the expedition sent by the University of Pennsylvania to Babylonia. I could not say more than that the fragments, taking into consideration the place where they were found and the peculiar characteristics of the cuneiform characters preserved upon them, sprang from the Cassite period of Babylonian history (ca. 1700–1140 B. C.); moreover, as the first character of the third line of the first fragment seemed to be KU, I

[3] Proceedings of the Society for Psychical Research, for June, 1896, pp. 13–17.

ascribed this fragment, with an interrogation point, to King Kurigalzu, whilst I placed the other fragment as unclassifiable, with other Cassite fragments, upon a page of my book where I published the unclassifiable fragments. The proofs already lay before me, but I was far from satisfied. The whole problem passed again through my mind that March evening before I placed my mark of approval under the last correction in the book. About midnight, weary and exhausted, I went to bed, and was soon in deep sleep. Then I dreamed the following remarkable dream. A tall, thin priest of the old pre Christian Nippur, about forty years of age, and clad in a simple abba, led me to the treasure chamber of the temple on its southeast side. He went with me into a small, low-ceiled room without windows, in which there was a large wooden chest, while scraps of agate and lapis lazuli lay scattered on the floor. Here he addressed me as follows: 'The two fragments which you have published separately upon pages 22 and 26, belong together, are not finger rings, and their history is as follows: King Kurigalzu (ca. 1300 B. C.) once sent to the temple of Bel, among other articles of agate and lapis lazuli, an inscribed votive cylinder of agate. Then we priests suddenly received the command to make for the statue of the god Ninib a pair of earrings of agate. We were in great dismay, as there was no agate as raw material at hand. In order to execute the command there was nothing for us to do but cut the votive cylinder into three parts, thus making three rings, each of which contained a proportion of the original inscription. The first two rings served as earrings for the statue of the god; the two fragments, which have given you so much trouble, are portions of them. If you will put the two together you will have a confirmation of my words. But the third ring you have not yet found in the course of your excavations, and you never will find it.' With this the priest disappeared. I awoke at once, and immediately told my wife the dream, that I might not forget it. Next morning—Sunday—I examined the fragments once more in the light of these disclosures, and to my astonishment found all the details of the dream precisely verified in so far as the means of verification were in my hands. The original inscription on the votive cylinder read: 'To the god Ninib, son of Bel, his lord, has Kurigalzu, pontifex of Bel, presented this.'

"The problem was thus at last solved. I stated in the preface that I had unfortunately discovered too late that the two fragments belonged together; made the corresponding changes in the 'Table of Contents,' pp. 50 and 52; and it being not possible to transpose the fragments, as the plates were already made, I put in each plate a brief reference to the other. [Cf. Hilprecht, "The Babylonian Expedition of the Uni-

versity of Pennsylvania," Series A, Cuneiform Texts, Vol I, Part 1, "Old Babylonian Inscriptions, chiefly from Nippur.] H. V. Hilprecht."

Upon the priest's statement that the fragments were those of a votive cylinder, Professor Hilprecht makes the following comment:

"There are not many of these votive cylinders. I had seen, all told, up to that evening, not more than two. They very much resemble the so-called seal cylinders, but usually have no pictorial representation on them, and the inscription is not reversed, not being intended for use in sealing, but is written as it is read."

Then there follows a transliteration of the inscription in the Sumerian language. Mrs. Hilprecht's statement is as follows:

"I was awakened from sleep by a sigh, immediately thereafter heard a spring from the bed, and at the same moment saw Professor Hilprecht hurrying into his study. Thence came the cry, 'It is so, it is so!' Grasping the situation, I followed him and satisfied myself in the midnight hour as to the outcome of his most interesting dream."

Signed, "J. C. Hilprecht."

A few weeks after the occurrence of this curious dream, there appeared a difficulty which Professor Hilprecht was not able to explain. "According to the memoranda in our possession, the fragments were of different colors, and, therefore, could have scarcely belonged to the same object. The original fragments were in Constantinople, and it was with no little interest that I [Mr. Newbold] awaited Prof. Hilprecht's return from the trip which he made thither in the summer of 1893. I translate again his own account of what he then ascertained.

"In August, 1893, I was sent by the Committee on the Babylonian Expedition to Constantinople, to catalogue and study the objects got from Nippur, and preserved there in the Imperial Museum. It was to me a matter of the greatest interest to see for myself the objects which, according to my dream, belonged together, in order to satisfy myself that they had both originally been parts of the same votive cylinder. Halil Bey, the director of the museum, to whom I told my dream, and of whom I asked permission to see the objects, was so interested in the matter that he at once opened all the cases of the Babylonian section, and requested me to search. Father Scheil, an Assyriologist from Paris, who had examined and arranged the articles excavated by us, before me, had not recognized the fact that these fragments belonged together, and consequently I found one fragment in one case and the other in a case far away from it. As soon as I found the fragments and put them together, the truth of the dream was demonstrated *ad oculos*—they had, in fact, once belonged to one and the same votive cylinder.

As it had been originally of finely veined agate, the stone-cutter's saw had accidentally divided the object in such a way that the whitish vein of the stone appeared only upon the one fragment, and the larger gray surface upon the other. Thus I was able to explain Dr. Peters' discordant descriptions of the two fragments."

There are, says Mr. Newbold, two especial points of interest in this case, the character of the information conveyed, and the dramatic form in which it was put. The apparently novel points of information given were:

1. That the fragments belonged together.
2. That they were fragments of a votive cylinder.
3. That the cylinder was presented by King Kurigalzu.
4. That it was dedicated to Ninib.
5. That it had been made into a pair of earrings.
6. That the "treasure chamber" was located on the southeast side of the temple.

We have a *point de repère* for the treasure chamber part of the dream, in the fact, that Dr. Peters, as far back as 1891, had told Professor Hilprecht of the discovery of a room in which were remnants of a wooden box, while the floor was strewn with fragments of agate and lapis lazuli.[1] The other points in the dream may be accounted for by the direction in which Professor Hilprecht's thoughts had been travelling, or they may not; I must confess to thinking they cannot all be so accounted for.—ALICE BODINGTON.

NOTE.—I would advise anyone interested in the subject of subconscious reasoning in dreams, to read at length the account given by William A. Lamberton, Professor of Greek in the University of Pennsylvania, of a dream in which he solved *geometrically* a difficult problem which he had attacked from its algebraic and analytic side. The *point de repère* here seems to have been a blackboard which had formerly had a functional use in the room, but which had been painted over, the black still showing through the white paint. Professor Lamberton, on opening his eyes one morning, about a week after he had determined to banish this insolvable problem from his mind, saw upon this blackboard surface a complete figure, containing not only the lines given by the problem, but also a number of auxiliary lines, and just such lines as without further thought solved the problem at once.

"I sprang from bed," says Prof. Lamberton, "and drew the figure on paper; needless to say, perhaps, that the geometrical solution being

[1] Two curious cases of the dramatic form taken occasionally by dreams will be found on p. 18, Proceedings S. P. R. for June, 1896.

thus given, only a few minutes were needed to get the analytical one." (Sub-Conscious Reasoning, Proc. S. P. R. pp. 11–13).—A. B.

"The Mimetic Origin and Development of Bird-language," and "The Evolution of Bird-song."—When one considers how many people are thinking at the same time, it does not seem strange that two persons, though widely separated and totally unknown to each other, should sometimes think not only of the same subjects but also follow in the same direction and practically at the same time, the same lines of original thought and investigation. Some of these duplicated ideas are of value in commerce; others are mere metaphysical speculations, possibly suggested by the same incidents; but at this late stage in the knowledge of natural history it does appear unusual that two people in different hemispheres and observing totally different species of animals should have simultaneously pursued independently the same far-reaching but novel line of speculative thought.

A few days ago, Mr. J. E. Harting called my attention to an article in THE AMERICAN NATURALIST, entitled "The Mimetic Origin and Development of Bird-language," which appeared in that journal for March, 1889. He did so because I had lately written a book on the subject, *The Evolution of Bird-song* (London, A. & C. Black, May, 1896), and because the article in question discussed some of my themes. I have just finished a perusal of the article, which was indeed rather exciting, since in nearly every paragraph I found an anticipation of some theory or observation of my own, which I had theretofore believed to be original. In fact, any one reading the article and afterwards reading *The Evolution of Bird-song*, would think that I had borrowed without acknowledgment a good many ideas thrown out by Mr. Samuel N. Rhoads, the writer of the essay in question. However, I am able to prove that in 1888 I had already made investigations on exactly the same lines as Mr. Rhoads, and had recorded the results of them in writing. In the summer of 1887 I began to make systematic records of the imitations I heard from imitative wild British birds, and in the course of this study various themes were attacked, such as "the influence of combat," "the influence of the love-call," "family-voices," and "the influence of imitation," etc. I wrote essays on these themes and sent them to the late Professor Harker, F. L. S. and some of them to Mr. S. S. Buckman (now an eminent geologist), with whom I had many conversations on the subjects in question. In 1890 these observations appeared, in a highly condensed form, in *The Zoologist*, in two papers entitled "The evolution of bird-song," and published respectively in

July and August of that year. I had then of course no idea that my seemingly daring suggestions that mimicry had attuned the cries of birds to their environment, had been confirmed or anticipated in America by a writer who, whatever may be the value of his deductions, is obviously an acute observer. My papers in *The Zoologist* were severely handled last year by a writer who certainly had never heard of Mr. Rhoads' article; and this year the same writer, in favorably criticising in *Nature* my new book, employed a few congratulatory words upon my having allowed certain of my former conclusions to drop into the background.

Although Mr. Rhoads and I were working on the same track, he will I am sure allow that I have gone into the subjects in much greater detail than would be possible within the limits of an article, unless it occupied the whole of the magazine in which it appeared. Mr. Rhoads traces the origin of certain tones to noises produced by the elements, such as the bubbling of air through mud, the murmurs of streams, the sibilant sounds caused by branches being rubbed against each other by the wind, the cries of the victims of predacious birds, the croakings of amphibians, and the moaning of wind in hollow trees; and I adopted the same position, though quoting different instances, in relation to each of these features. He touches on heredity, in a way that would suggest the working-out of the theme in much the same way as I have attempted to do it. In his suggestion of the original use of the voice in "hissing or choking sounds," and in my surmise that the voice was "evolved from a toneless puffing indicative of anger, or from snorts or grunts accidentally caused," in support of which idea some pertinent evidence may be adduced, we have both, I think, advanced somewhat from Darwin's proposition that involuntary and purposeless contractions of the muscles of the chest and glottis, due to excitement of the sensorium, first gave rise to the emission of vocal sounds (*Expression of the Emotions*, pp. 83, 84).

In order to show, however, that I have not been limited to only those themes which Mr. Rhoads treats in so terse and yet so attractive a style, I would mention merely the "contents" of one of my chapters, in which some side-issues are dealt with, as follows:

> "Songs are generally uttered by males: exceptions—Not until birds have attained full size: exceptions—Most frequently at morning and evening: influence of weather—Tendency to rise in pitch with vehemence—Only small birds properly sing—Singers arboreal birds generally—Effect of living amid foliage: on size, hearing, and voice—Accent in songs—Singers clad in sober hues—Devel-

opment of the eyes in detecting danger—Necessity of leisure—Labours of parent-birds—Laborious and stealthy birds habitually poor in song—Flight in song: for purposes of display—Fluttering of wings a means of address—Ventriloquism—Singing in chorus."

The study of bird-song, on the lines indicated by Mr. Rhoads and myself, is so new and so delightful a pursuit that I hasten to ask readers of THE AMERICAN NATURALIST to peruse his paper once more; for it is in America, so richly blessed with birds, that such investigations can be most easily developed, and that they promise the most accurate and helpful results.—CHARLES A. WITCHELL.

A Note on Dr. Herbert Nichols' Paper (Amer. Nat., Sept., 1896).—Readers of Dr. Herbert Nichols' paper on my article entitled "A New Factor in Evolution" will understand that its intemperate spirit should rule out all reply. I may say, however, that Dr. Nichol's "home thrusts" are all directed at my view of pleasure and pain, which he considers, quite mistakenly, the point of my paper. On the contrary the "factor" is entirely the influence of the individual's adaptations on the course of evolution; not at all the particular way in which the individual makes its adaptations. I took pains to reiterate this distinction in the paper, saying (AMER. NAT., 1896, p. 542-3) "So far we have been dealing exclusively with facts . . . . . without prejudicing the statement of fact at all, we may inquire into the actual working of the organism in making its adaptations. . . . . Before taking this up, I must repeat with emphasis that the position taken in the foregoing pages, which simply makes the fact of ontogenetic adaptation a factor in (race) development, is not involved in the solution of the farther question as to how the adaptations are secured." So I see absolutely no point in Dr. Nichols' criticisms.

The other question, which involves pleasure and pain, is discussed in the latter part of my paper; but it is not that, but my book which Dr. Nichols attacks with the grossest misunderstanding. I do not at all believe the main things which he attributes to me; first, the position that there are no pain nerves, and second, that there is a "psychic factor" which is an "efficient cause" in evolution. Psychologists know Dr. Nichols' hobby and allow for his intemperateness.

J. MARK BALDWIN.

Princeton, Sept. 25, 1896.

MICROSCOPY.[1]

Methylen Blue.—A few points observed in the use of Erlich's methylen blue method by the investigators in the Marine Biological Laboratory at Woods Holl, Mass. may be of general interest.

This method has been successfully applied during the past summer to the study of the nervous system in a great variety of forms including vertebrates, crustacea, annelids, echinoderms and tunicates.

Ehrlich's *intra vitam* methylen blue prepared by Grübler was used for staining the nerve tissues. The stain was applied by injecting a 1–½ per cent solution of the methylen blue made in normal salt solution, into the blood vessels, body cavity or lymph spaces or by immersing small animals or excised pieces of nerve tissue in a weak solution.

The method of application and strength of the solution were determined by experiment for each animal and tissue. During the action of the stain, the animal or tissue was kept as nearly as possible in its normal condition. Everything seems to depend on keeping the tissue alive, and in bringing the stain in contact with it in a solution of a strength suitable for obtaining the best results.

The abundant supply of oxygen to the staining tissue was of great importance in some cases, while in others it seemed to make little difference.

It was found, as suggested by Dr. C. Huber, that animals which live in the dark, stain better in the dark than in the light.

The relaxation of the tissues by the use of chloroform or chloral hydrate seemed to be more favorable for the staining of some elements of the nervous system, while others did not stain which stained in the unchloroformed animal.

It was found that recently caught and perfectly normal animals stained more satisfactorily than those which had been kept in confinement for some time, unless under very favorable conditions.

In the case of the dogfish, active animals were killed by decapitation. The stain was applied by injecting a 1–½ per cent solution of the methylen blue into the blood vessels for the central nervous system and by immersing small pieces of nerve tissue in a weak solution of the stain for the sense organs.

The length of time required for the *intra vitam* staining varied widely, annelids requiring 4–5 hours, while dogfish only require 1–½ hours, either by injection or by immersing the tissue in the stain.

[1]Edited by C. O. Whitman, University of Chicago.

When small transparent pieces of tissue were to be examined, they were fixed in a saturated solution of picrate of ammonia in distilled water from 2–4 hours and were then mounted in a mixture of equal parts of pure glycerine and distilled water to which a small quantity of picrate of ammonia is added. When opaque or large pieces were fixed in this way they were sectioned by the freezing method. After fixing in the picrate of ammonia, the tissue was placed in a saturated solution of sugar for one hour and was then transferred to a piece of blotting paper to remove the syrup from its surface. It was then placed in a thick solution of gum arabic for fifteen minutes and then transferred to the plate of the freezing microtome where it was frozen by means of liquid carbonic acid. The sections were mounted in dilute glycerine as in the other case. The principal advantage of this method is its rapidity, but neither serial sections nor those of equal thickness can be obtained.

In order to obtain serial sections by the paraffine method, the tissues were fixed in Berthe's Fluid.[2]

For vertebrates:	For invertebrates:
Molybdate of ammonia, 1 gram.	Molybdate of ammonia, 1 gram.
Distilled water, 10 c. c.	Distilled water, 10 c. c.
Hydrochloric acid, 1 drop.	Peroxide of Hydrogen, ½ c. c.
Peroxide of Hydrogen, 1 c. c.	

A different formula is used for tissues of invertebrates as less oxygen is required than for vertebrates. The fixing fluid must be cooled on ice before placing the tissue in it. After remaining in the cold fixing fluid for from 2–4 hours the tissue is thoroughly washed with cold water which generally takes about two hours although it has been continued for twelve hours without injury.

It is necessary to remove all the molybdate of ammonia by thorough washing if permanent preparations are to be secured.

The tissue is then passed rapidly, ten to fifteen minutes in each, through the ordinary grades of alcohol to absolute, all being kept cold with ice. The tissue should be left in the absolute alcohol for about two hours at a freezing temperature and the alcohol be changed several times. The stain is dissolved by dilute alcohol at ordinary temperatures.

Dr. Huber's plan of placing the tissue directly in cold absolute alcohol on removing it from the water and changing several times for a period of two hours, gave good results.

[2] Archiv. f. Mikros., Anat. Bd. 44, Heft 4.

After thorough dehydration the tissue is placed in xylol for 12–24 hours and changed several times. It is then imbedded in paraffine in the usual way.

The most complete and in every way satisfactory staining of the sensory nervous system was obtained by two or three injections of a ½ per cent solution of Erlich's methylen blue at intervals of from 15 to 20 minutes, both with vertebrates and invertebrates, as suggested by Semi Meyer.[3]

The tissues relaxed after the first injection so that more fluid was introduced by the second and third injections than by the first.

The use of chloroform was found to be wholly unnecessary by this method. Meyer uses a very strong solution of B. X. methylen blue, 5 per cent to 6 per cent, in water.

The paraffine sections should generally be quite thick (45–60 $M\mu$).—A. D. MORRILL, Hamilton College, Clinton, N. Y.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Sciences **(continued from page 779)**.—Prof. A. S. Packard was elected to represent the Association on the American advisory board to coöperate with the American member of the international commission on rules of nomenclature. The following were elected to represent the Association at the International Congress of Geologists to be held in St. Petersburg in September, 1897: Prof. Jas. Hall, Prof. E. D. Cope, Prof. B. K. Emerson, Prof. C. D. Walcott, Prof. W. N. Rice.

The following sectional officers were elected to serve at the meeting of 1897, at Detroit.

Vice-Presidents.—A, Mathematics and Astronomy.—W. W. Beman, of Ann Arbor, Mich. B, Physics.—Carl Barus, of Providence, R. I. C, Chemistry.—W. P. Mason, of Troy, N. Y. D, Mechanical Science and Engineering.—John Galbraith, of Toronto, Can. E, Geology and Geography.—I. C. White, of Morgantown, W. Va. F, Zoology.—G. Brown Goode, of Washington, D. C. G, Botany.—George F. Atkinson, of Ithaca, N. Y. H, Anthropology.—W. J. McGee, of Washington, D. C. I, Social and Economic Science.—Richard T. Colburn, of Elizabeth, N. J.

[3] Archiv. f. Mikros. Anat. Bd. 46. Heft 2, and Bd. 47. Heft 4.

Permanent Secretary.—F. W. Putnam, of Cambridge, Mass. (Office, Salem, Mass.).

General Secretary.—Asaph Hall, Jr., of Ann Arbor, Mich.

Secretary of the Council.—D. S. Kellicott, of Columbus, O.

Secretaries of the Sections.—A, Mathematics and Astronomy.—James McMahon, of Ithaca, N. Y. B, Physics.—Frederick Bedell, of Ithaca, N. Y. C, Chemistry.—P. C. Freer, of Ann Arbor, Mich. D, Mechanical Science and Engineering.—John J. Flather, of Lafayette, Ind. E, Geology and Geography.—C. H. Smith, Jr., of Clinton, N. Y. F, Zoology.—C. C. Nutting, of Iowa City, Ia. G, Botany.—F. C. Newcombe, of Ann Arbor, Mich. H, Anthropology.—Harlan I. Smith, of New York. I, Social and Economic Science.—Archibald Blue, of Toronto, Ont.

Treasurer.—R. S. Woodward, of New York, N. Y.

It was ordered that in future the Vice-Presidents should be called Chairmen of the Sections in the publications of the Association.

Two evening lectures were given to the citizens of Buffalo, viz., The History of the Niagara Gorge, by Dr. J. W. Spencer, and the Results of Cave Exploration and its relation to the Antiquity of Man in North America, by E. D. Cope.

The following papers in the natural sciences were read:

Geology.—*Tuesday, August 25.*—Notes on the Artesian Well sunk at Key West, Florida, in 1895, by Edmund Otis Hovey; The Hydraulic Gradient of the Main Artesian Basin of the Northwest, by J. E. Todd; The true Tuff-beds of the Trias, and the mud enclosures, the underrolling, and the basic pitchstone of the Triassic Traps, by B. K. Emerson; Volcanic Ash from the North Shore of Lake Superior, by N. H. Winchell and U. S. Grant; The Tyringham (Mass.) "Mortise Rock," and pseudomorphs of Quartz after Albite, by Ben. K. Emerson; The Succession of the Fossil Faunas in the Hamilton group at Eighteen Mile Creek, N. Y., by Amadeus W. Grabau; Development of the Physiography of California. Lantern pictures, by James Perrin Smith; Synopsis of California Stratigraphy, by James Perrin Smith; Ancient and Modern Sharks and the Evolution of the Class, by E. W. Claypole.

Wednesday, August 26.—The Discovery of a new Fish Fauna, from the Devonian Rocks of Western New York, by F. K. Mixer; The Cuyahoga Preglacial Gorge in Cleveland, Ohio, by Warren Upham; The Operations of the Geological Survey of the State of New York, by James Hall; A Revision of the Moraines of Minnesota, by J. E. Todd; Origin of the High Terrace Deposits of the Monongahela

River, by I. C. White; Observations on the Dorsal Shields in the Dinichthyids, by Charles R. Eastman.

Zoology.—*Tuesday, August 25.*—On the Entomological Results of the Exploration of the British West India Islands by the British Association for the Advancement of Science, by L. O. Howard; Warning Colors, Protective Coloration and Protective Mimicry, by F. M. Webster; On Life Zones in West Virginia, by A. D. Hopkins; On the Variations of Certain Species of North American Odonata, by D. S. Kellicott; A Case of Excessive Parasitism, by L. O. Howard; Notes on the Occurrence of Dragonflies in Ohio in 1896, by D. S. Kellicott; Scyllarus and Anemonia—A Case of Semi-commensalism, by Edward L. Rice.

Botany.—*Tuesday, August 25.*—The Relation of the Growth of Leaves to the CO_2 of the Air, by D. T. MacDougal; Directive Forces Operative in Leaf Rosettes, by R. N. Day; On Crataegus coccinea and Its Segregates, by N. L. Britton; The Distribution of the Species of Gymnosporangium in the South, by L. M. Underwood and F. S. Earle; Morphology of the Canna Flower, by L. H. Bailey; A Comparison of the Flora of Erie Co., Ohio, with that of Erie Co., New York, by E. L. Moseley; The Point of Divergence of Monocotyledons and Dicotyledons, by C. E. Bessey; On the Bacterial Flora of Cheddar Cheese, by H. L. Russell; The Terminology of Reproductive Organs, by C. R. Barnes; A Comparative Study of the Development of Some Anthracnoses in Artificial Cultures, by Bertha Stoneman.

Anthropology.—*Tuesday, August 25.*—Resolution on the death of Capt. Bourke, Secretary of the Section, followed by a memorial by Washington Matthews.

A Ceremonial Flint Implement and Its Use among the Ancient Tribes of Tennessee, by Gates P. Thurston; Symbolic Rocks of Byfield and Newbury, Mass., by Horace C. Hovey; An Analysis of the Decoration upon Pottery from the Mississippi Valley, by C. C. Willoughby; Brief Description of the Prehistoric Ruins of Tzac Pokoma, Guatemala, by John Rice Chandler; Human Relics from the Drift of Ohio, by W. Claypole; Fresh Geological Evidence of Glacial Man at Trenton, New Jersey, by G. Frederick Wright.

Sociology.—*Tuesday, August 25.*—The Monetary Standard, by W. H. Hale; The Competition of the Sexes and Its Results, by Lawrence Irwell; Fashion—A Study, by S. Edward Warren; Citizenship, Its Privileges and Duties, by Stillman F. Keeland; An Inheritance for the Waifs, by C. F. Taylor.

Wednesday, August, 26.—The Proposed Sociological Institution, by James A. Skilton; What is True Money? by Edward Atkinson; The Value of Social Settlement, by Aaron B. Keeler; The Wages Fund Theory, by Aaron B, Keeler.

Thursday, August 27.—Better Distribution of Forecasts, by John A. Miller; The Tin Plate Experiment, by A. P. Winston; Relics of Ancient Barbarism, by S. F. Kneeland; Suicide Legislation, by W. Lane O'Neill.

Geology.—*Wednesday, August 26.*—Wednesday afternoon was given to a meeting in commemoration of the sixtieth anniversary of of Professor Hall's work in connection with the New York Survey.

The presiding officer spoke briefly in behalf of the Association; and Professor Joseph LeConte, President of the Geological Society, spoke for that Society.

Professor Hall was present and responded in person.

James Hall, Founder of American Stratigraphic Geology, by W. J. McGee; Professor Hall and the Survey of the Fourth District, by John M. Clarke.

Thursday, August 27.—Sheetflood Erosion, by W. J. McGee; Post-Cretaceous Grade-Plains in Southern New England. By F. P. Gulliver.

Thursday Afternoon.—Excursion to Eighteen Mile Creek.

Saturday, August 29.—Excursions.

Zoology.—*Wednesday, August 26.*—Notes Upon Cordylophora, by C. W. Hargitt; Modification of the Brain During Growth, by Susanna Phelps Gage; Structure and Morphology of the Oblongata of Fishes, by B. F. Kingsbury; Differentiation of Work in Zoology—in Secondary Schools, by William Orr, Jr.; Field Work and Its Utility, by James G. Needham; Appendages of an Insect Embryo, by Agnes M. Claypole; Experiments Upon Regeneration and Heteromorphosis, by C. W. Hargitt; The Penial Structures of the Saurians, by E. D. Cope; A Note on the Membranous Roof of the Prosencephal and Diencephal of Ganoids, by B. F. Kingsbury.

Anthropology.—*Wednesday, August 26.*—Indian Wampun Records, by Horatio Hale; Seri Stone Art, by W. J. McGee; The Beginning of Zoöculture, by W. J. McGee; Resolution upon the appointment of a Committee to report on "The Ethnography of the White Race in the United States," by Daniel G. Brinton; Onondaga Games, by W. M. Beauchamp; Meaning of the Name Manhattan, by William Wallace Tooker; Kootenay Indian Place Names, by A. F. Chamberlain; Kootenay Indian Names of Implements and Instruments, by A. F. Chamberlain; Aboriginal Occupation of New York, by W. M. Beauchamp;

Clan System of the Pueblos, by F. W. Hodge; The Psychic Source of Myths, by Daniel G. Brinton; The Limitation of the Comparative Method in Anthropology, by Franz Boas.

Sociology.—*Wednesday, August 26.*—The Proposed Sociological Institution, by James A. Skilton; The Value of Social Settlement, by Aaron B. Keeler; Human Reciprocity, by Mary J. Eastman; Better Distribution of Forecasts, by John A. Miller; The Tin Plate Experiment, by A. P. Winston; Relics of Ancient Barbarism, by S. F. Kneeland; Suicide Legislation, by W. Lane O'Neill; Crime Against Labor, by Edward Atkinson.

Geology.—*Thursday, August 27.*—Notes on Certain Fossil Plants from the Carboniferous of Iowa, by Thomas H. Macbride; The Making of Mammoth Cave, by Horace C. Hovey; The Colossal Cavern, by Horace C. Hovey; Sheetflood Erosion, by W. J. McGee; Glacial Flood Deposits in the Chenango Valley, by Albert P. Brigham; Origin of Conglomerates, by T. C. Hopkins; Origin of the Topographic Features in North Carolina, by Collier Cobb; The Cretaceous Clay Marl Exposure at Cliffwood, N. J., by Arthur Hollick; Post-Cretaceous Grade-Plains in Southern New England, by F. P. Gulliver; The Eocene Stages of Georgia, by Gilbert D. Harris; The Origin and Age of the Gypsum Deposits of Kansas, by G. P. Grimsley; Geomorphic Notes on Norway, by J. W. Spencer; The Slopes of the Drowned Antillean Valleys, by J. W. Spencer; The "Augen-Gneiss," Pegmatite Veins, and Diorite Dikes at Bedford, Westchester Co., N. Y., by Lea McI. Luquer and Heinrich Ries; Notes on Kansan Drift in Pennsylvania, by E. H. Williams; Preliminary Notes on the Columbian Deposits of the Susquehanna, by H. B. Bashore.

Thursday Afternoon.—Excursion to Eighteen Mile Creek.

Zoology.—*Thursday, August 27.*—The Peritoneal Epithelium in Amphibia, by Isabella M. Green; Presented by Simon H. Gage; The Heart of the Lungless Salamanders of Cayuga Lake, by Grant S. Hopkins; Observations on the Chameleon, *Anolis principalis*, by Geo. V. Reichel; Energy in Animal Nutrition; Relative efficiency of Animals as machines, by Manly Miles; Some Abnormal Chick Embryos, by C. W. Hargitt; On a peculiar Fusion of the Gill-filaments in certain Lamellibranchs, by Edward L. Rice; The Relationships of the North American Fauna, by Theodore Gill.

Botany.—*Wednesday, August 26.*—The development of the vascular elements in Indian Corn, by W. W. Rowlee; Some remarks on chalazogamy, by J. M. Coulter; The habits of the rarer ferns of Alabama, by L. M. Underwood; On the stem anatomy of certain Onagraceæ, by

Francis Ramaley; The point of divergence of Monocotyledons and Dicotyledons, by C. E. Bessey; Notes on the pine inhabiting species of Peridermium, by L. M. Underwood and F. S. Earle; Reaction of leaves to continual rain fall, by D. T. MacDougal; Studies in nuclear phenomena, and the development of the ascospores in certain Pyrenomycetes, by Mary A. Nichols; The stigma and pollen of Arisæma, by W. W. Rowlee; Notes on the genus Amelanchier, by N. L. Britton; Remarks on the northern species of Vitis, by L. H. Bailey; On the formation and distribution of abnormal resin ducts in Conifers, by Alex. P. Anderson; The development of the cystocarp of Griffithsia bornetiana, by Arma A. Smith; Notes on the allies of the sessile Trillium, by L. M. Underwood; On an apparently undescribed Cassia from Mississippi, by C. L. Pollard; A bacterial disease of the squash bug (*Anasa tritis*), by B. M. Duggar; What is the bark? by C. R. Barnes; Embryo-sac structures, by J. M. Coulter; Some Cyperaceæ new to North America, with remarks on other species, by N. L. Britton; Grasses of Iowa, by L. H. Pammel; Ceres-Pulver: Jensen's new fungicide for the treatment of smut, by W. A. Kellerman; On the Cardamines of the *C. hirsuta* group, by N. L. Britton; The relation between the genera, Polygonella and Thysanella, as shown by a hitherto unobserved character, by John K. Small; An apparently undescribed species of Prunus from Connecticut, by John K. Small; The flora of the summits of King's Mountain and Crowder's Mountain, North Carolina, by John K. Small; Parthenogenesis in *Thalictrum fendleri* by David F. Day; Notes on the family Pezizaceæ of Schröter, by Elias J. Durand; What should constitute a type specimen, by S. M. Tracy; Rheotropism and the relation of response to stimulus, by F. C. Newcombe; Some adaptation of shore plants to respiration, by Hermann von Schrenk; Influence of rainfall upon leaf forms, by D. T. MacDougal; The mechanism of curvature in tendrils, by D. T. MacDougal.

Thursday, August 27.—The Beginning of Zoöculture, by W. J. McGee; Onondaga Games, by W. M. Beauchamp; Meaning of the Name Manhattam, by William Wallace Tooker; Kootenay Indian Place Names, by A. F. Chamberlain; Kootenay Indian Names of Implements and Instruments, by A. F. Chamberlain; Physical and Mental Measurements of Students of Columbia University, by J. McKee Cattell; Anthropometry of the Shoshone Indians, by Franz Boas; Recent Discoveries and Discussions as to Pygmy Races, by R. G. Haliburton; The Papago Time Concept, by W. J. McGee; Notes on the Theological Development of one Child, by Fanny D. Bergen; Certain

Shamanistic Ceremonies among the Ojibways, by Harlan I. Smith; Notes on Certain Beliefs concerning Will Power among the Siouan Tribes, by Alice C. Fletcher; Pueblo Indian Clans, by F. W. Hodge; Mescal Plant and Rite, by James Mooney.

Geology.—*Friday, August 28.*—Glacial Flood Deposits in the Chenango Valley, by Albert P. Brigham; Origin of Conglomerates, by T. C. Hopkins; Origin of Topographic Features in North Carolina, by Collier Cobb; The Cretaceous Clay Marl Exposure at Cliffwood, N. J., by Arthur Hollick; Post-Cretaceous Grade-Plains in Southern New England, by F. P. Gulliver; The Niagara Falls Gorge, by George W. Holley; The Algonquin River, by G. K. Gilbert; The Whirlpool Saint Davids Channel, by G. K. Gilbert; Profile of the Bed of the Niagara in its Gorge, by G. K. Gilbert; Origin and Age of the Laurentian Lakes and of Niagara Falls, by Warren Upham; Correlation of Warren Beaches with Moraines and Outlets in Southeastern Michigan, by F. B. Taylor: Notes on the Glacial Succession in Eastern Michigan, by F. B. Taylor; The Eocene Stages of Georgia, by Gilbert D. Harris; The Origin and Age of the Gypsum Deposits of Kansas, by G. P. Grimsley; Geomorphic Notes on Norway, by J. W. Spencer; The Slopes of the Drowned Antillean Valleys, by J. W. Spencer; The "Augen-Gneiss," Pegmatite Veins, and Diorite Dikes at Bedford, Westchester Co., N. Y., by Lea McI. Luquer and Heinrich Ries; Notes on Kansan Drift in Pennsylvania, by E. H. Williams; Preliminary Notes on the Columbian Deposits of the Susquehanna, by H. B. Bashore.

Anthropology.—*Friday, August 28.*—Finger Prints of American Indians, by Fred. Starr; The Temple of Tepoztlan, Mexico, by M. H. Saville; The Preservation of Local Archæological Evidence, by Harlan I. Smith; Character and Food, by George V. Reichel; Some Indian Rock and Body Painting in Southern California, by David P. Barrows; Recent Explorations in Honduras by the Peabody Museum, by F. W. Putnam; Pueblo Indian Clans, by F. W. Hodge; Mescal Plant and Rite, James Mooney; Finland Vapor Baths, by H. W. Smith; Cupped Stones, by Franz Boas.

Saturday, August 29.—An excursion to Niagara City, Falls and Gorge was given by the citizens of Buffalo. The party took steamboat to a point on the Canadian side above the Falls, and then took trolley down the river. Fine views of the Falls were had. At Lewiston the river was crossed in a steamboat, and the trolley line up the river carried the party past the rapids and the whirlpool, of which magnificent views were obtained. After dinner at the International Hotel, the establishments of the Power Company and of the Carborundum Company were examined, and the company returned to Buffalo.

SCIENTIFIC NEWS.

Dr. G. Brown Goode, Assistant Secretary of the Smithsonian Institution and Director of the National Museum, died in Washington, Sept. 6th.

Dr. Goode was born in New Albany, Ind., February 13, 1851. As a boy he developed a fondness for natural history. In time he prepared for college and entered Wesleyan University, Middletown, Conn., where he graduated in 1870. During his college career he devoted himself assiduously to the study of natural history, to which his tastes inclined, rather than to classical studies. He took an active part in assembling and arranging collections that culminated in the museum now preserved in the Orange Judd Hall. It was while so engaged that he met Prof. Baird at Eastport, Me., and at once became associated as a volunteer in the work of the United States Fish Commission. The acquaintance thus formed with Prof. Baird continued until the death of Mr. Baird and had very much to do with Dr. Goode's subsequent career.

During the winter of 1872–'73 he made his first trip to the West Indies, and collected fish, which he exchanged with the Smithsonian Institution, and on his return, at the invitation of Prof. Baird, he devoted a part of his time to the institution. In 1873 he joined permanently the staff of the Smithsonian Institution, and has since continued in its service, becoming Assistant Secretary in 1887.

Meanwhile, he took an active part in the preparation of the exhibit of the Smithsonian Institution at the Centennial Exhibition at Philadelphia in 1876, and owing to the illness of Prof. Baird, the charge of that work devolved largely on him during the continuance of the fair. At the end of the exhibition the care of the collections that were then given to the United States government was mainly assigned to him, and to him more than any one else is due the present condition of the National Museum.

His volunteer connection with the United States Fish Commission meanwhile continued, and it was through his relation there that he acquired the well earned reputation of being the leading authority on the fishes and fisheries in the United States. It was this that led, in 1880, to his appointment to the charge of the fisheries division of the tenth census. On the death of Prof. Baird, although the entire care of the Museum fell upon him, Dr. Goode was made Fish Commissioner,

and continued in that place, which position he retained only until the the law could be amended, making that office an independent one. His relation to the Fish Commission led naturally to his serving as United States Commissioner to the Fisheries Exhibition in Berlin in 1880, and in London in 1883.

His experience gained at the Centennial Exhibition in 1876 resulted in his being placed at the head of the Smithsonian Institution and National Museum exhibits at the expositions in New Orleans, Cincinnati, Louisville, and Atlanta. He also served in charge of the exhibition of the National Museum at the Columbian Exposition, in Chicago, in 1893.

In all of this work his remarkable genius for museum administration manifested itself, and the success of the national exhibits was largely due to his remarkable abilities.

Of his many publications the most important were in the line of his chosen science, ichthyology. Among them, worthy of commendation, are "The Game Fishes of the United States," 1879; "The Fisheries and Fishing Industries of the United States" (7 vols.), 1884; "American Fishes," 1887, and with T. H. Bean, "Oceanic Ichthyology," 1893. His writings on museum work include, "Plan of Classification for the World's Columbian Exposition," 1890, and "Museums of the Future, 1890, both of which are quoted as authority the world over. Mention must be made of his interest in genealogy. As a boy he began the preparation of the genealogy of his family, which resulted in 1888 in "Our Virginia Cousins." This led naturally to his being chosen one of the editors of the "Wesleyan Book," and later to his active participation in the founding of the American Historical Association, in the proceedings of which he published "The Origin of the National Scientific and Educational Institutions of the United States" in 1890.

Dr. Goode was one of the founders of the District of Columbia Society of the Sons of the American Revolution, becoming at once one of the officers, and since 1894, its President. He was also a Vice-President of the Sons of the Revolution and a Deputy Governor of the Society of Colonial Wars. In the scientific societies of Washington City he was ever a prominent member, having been President of the Philosophical Society and the Biological Society. He had been President of the Cosmos Club, and was at the time of his death an overseer of the Columbian University, and in many other ways had been actively associated with the intellectual progress of the National Capital.

In addition, he was a member of many of the leading scientific societies, both in this country and abroad, including the Zoological Society of London, the National Academy of Sciences in the United States, and was recently elected Vice President of the American Association for the Advancement of Science for the Section on Zoology.

Dr. Goode had received the degree of Ph. D. from the Indiana University, and that of LL. D. from Wesleyan University, and his services at the Madrid Exposition gained for him the decoration of Isabella.

Dr. Goode was respected and loved by all who knew him, and he was recognized as a fit successor to Professor Baird, the founder of the National Museum.

Josiah Dwight Whitney, Professor of Geology at Harvard University, died at New London, N. H., at the age of 77 years. He was graduated from Yale in 1839, and from that time until his death he was actively engaged in geological research. His field work included a survey of New Hampshire, a geological exploration of the Lake Superior region, and a survey of the mining regions of all the States east of the Mississippi. In 1855 he was appointed State Chemist of Iowa, and was a member of the faculty of the Iowa State University, later also held the position of State Geologist of California. He was appointed Professor of Geology at Harvard in 1860. In time this position was guaranteed him for life in consideration of the gift of his geological library to the museum of that institution. Prof. Whitney was one of our ablest geologists, and like many men of genius he belonged to the genus irritabile. He was an educated musician, no doubt finding that music is useful for "nerves." He had little patience with lay stupidity, and did not always conciliate "the powers that be."

It will be recalled that the Third International Zoological Congress (Leyden, Sept., 1895) appointed an International Commission of five members to study the various codes of nomenclature in use in different countries, with a view to arriving at a more definite international agreement upon the points of difference to be found in these codes. This Commission is composed of Dr. Raphael Blanchard (France), Prof. Carus (Germany), Prof. Jentink (Holland), Dr. Sclater (England) and Dr. Stiles (United States).

It will also be recalled that Dr. Stiles requested the appointment of an American Advisory Committee, to which he might "submit for approval or disapproval all of the questions which he intended to sup-

port in the meetings of the International Commission and with which he might advise regarding concessions to be made or requested in those points upon which American opinion differs from the views held in some of the other countries."

This Advisory Committee has now been completed and is made up as follows:

Dr. Gill, representing the National Academy of Science.

Dr. Dall, representing the Smithsonian Institution.

Prof. Cope, representing the Society of American Naturalists.

Prof. Wright, representing the Royal Society of Canada.

Prof. Packard, representing the American Association for the Advancement of Science.

The September issue of the Western Field and Stream, published in St. Paul, Minn., is noteworthy as presenting a scheme for the protection of the game of the country. Briefly, it contemplates dividing the entire territory of the United States from the Atlantic to the Pacific, into two concessions along the line of the forteith parallel of latitude, or near it, for each of which there shall be uniform laws and uniform close time, the whole to be under the police surveillance of the National association for the protection of game and fish through its multifarious state auxilliaries. The close time for the northern concession will be from January 1 to September 1, and in the southern concession from February 1 to September 1, during which no shooting shall be allowed on any kind of game whatever, excepting that woodcock and shore birds of the order Limicolæ may be shot in August. The general close time for all kinds of inland fishes, recognized as game fishes, to extend from October 1 to June 1, excepting that fishes of the family Samonidæ, may be caught in April and may. These close seasons conform very nearly to the distribution, habitat, and breeding seasons of the various animals which are sought to be protected; and where they do not, especial exceptions may be made, if deemed expedient. The laws which are to dominate will inhere by legislative enactment; uniform in all the states, and coöperative throughout. Emergencies and bodily stress will always stand in plea for exemption from penalty for violation of the laws when well proven.

By private gifts, a Japanese fellowship in economics has been established at the University of Wisconsin, and Mr. M. Shiozawa, of Tokyo, Japan, has been elected to the fellowship for the coming year. Mr. Shiozawa is highly recommended by two distinguished Japanese pro-

fessors, Professor Iyenaga, of the Higher Commercial College, of Tokyo, Japan, and Professor Motora, of the Imperial University, of the same city. He is spoken of as one of the talented young men of Japan, and it is expected he will do a great work for his native country. He has already graduated from a Japanese college, and has published results of his work. He is now on his way to this country to enter upon his studies at Madison.

The members of the Geological Society of France attending the meeting to be held in Algiers, October 6, 1896, will have an opportunity of examining the following localities: October 8–13, Sahel d'alger, Massif de Blida, Médéa; October 14–18, Kabylie du Djurjura; October 19–26, Constantine, Batna and Biskera. In addition to these excursions there will be one preliminary to the meeting. Mr. Brive proposes, October 3–5, to conduct a party to Chélif and Dakra to study the Miocene and Pliocene beds of these districts.

The Brooklyn Institute of Arts and Sciences has in process of construction a Museum of Arts and Sciences. It is proposed to group on one of the four porticos the names of seven great and representative men in science; on another, seven great and representative men in art; on a third, seven great and representative names in philosophy; and on the fourth, seven great and representative names in the realm of the "practicum" or the application of science and art to the so-called material wants of men.

Information has been received that Prof. Daniel G. Elliott, of the Field Museum, Chicago, who is now travelling in Somaliland, has returned to Berbera from Gallas Mountains. He intends to make arrangements at once for exploring the interior of the country. He has been fortunate in securing a good collection of the fauna of the country, including quite rare species.

The well-known naturalist Mr. Charles H. Sternberg has been collecting fossil plants in the Dakota Group in Kansas during the past season, and has obtained a collection of fine specimens which he offers for sale, either as a whole, or by the single specimen.

The first or "general" part of Dr. Richard Hertwig's *Lehrbuch der Zoologie* has been translated by Professor George W. Field of Brown University, and will be published soon by Henry Holt & Co.

Errata of Paper on The Mushroom Bodies of the Hexapod Brain in the August No.

Page 644, line 6, after "Fig" insert I.
" 646, " 31, before "uses" insert and.
" 647, " 11, for "brahlets" read branchlets.
" 647, " 16, insert coma at the end of the line.
" 647, " 31, insert coma at the end of the line.
" 647, " 34, for "Formol-" read formol-.
" 648, " 1, for "which" read a bundle that.
" 648, after "Fig." insert I.
" 649, " 3, for "afferent" read efferent.
" 649, " 19, after "some" insert of.
" 649, in note for "Dujardin" read Dujardin's.
" 649, line 11, for "crythrocephala" read erythrocephala.
" 649, " 12, for "Gehirus" read Gehirns.
" 649, " 12, for "Diehl" read Dietl.
" 649, " 17, for "Ordunung" read Ordnung.
" 649, " 19, for "Fourmics" read Fourmis.
" 649, " 24, for "Retzins" read Retzius.
" 649, " 30, for "trachéátes" read tracheates.
" 649, " 32, for "Mémorie" read Mémoire.

F. C. KENYON.